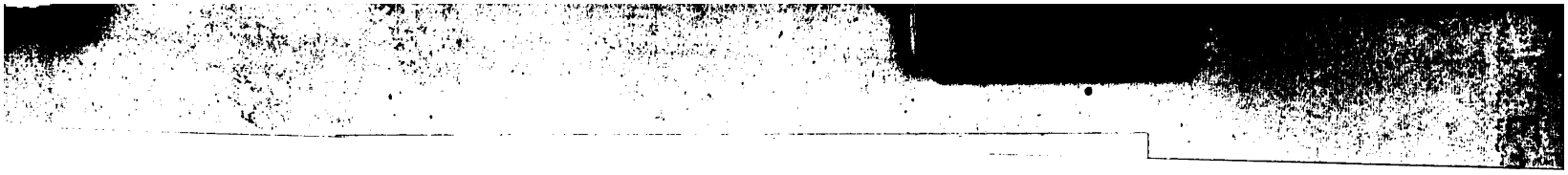

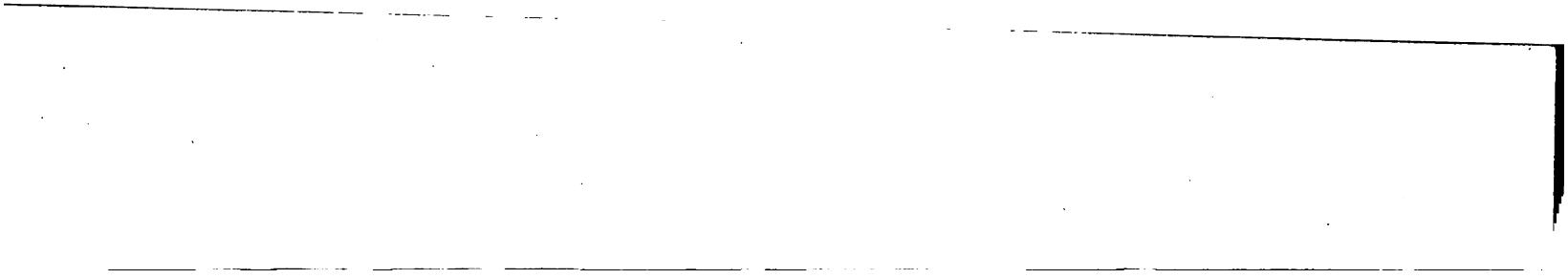

PROCEEDINGS

OF THE

THIRTEENTH ANNUAL CONVENTION

OF THE

AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS

HELD AT

BIRMINGHAM, ALA., OCT. 9, 10, 11 and 12

1906

THE NEXT MEETING WILL BE HELD AT DETROIT, MICH., THIRD WEEK OF SEPT., 1907.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS

OFFICERS

1906-1907

President	M. R. SHERRERD	Newark, N. J.
First Vice-President	JAS. OWEN	Montclair, N. J.
Second Vice-President	JULIAN KENDRICK	Birmingham, Ala.
Third Vice-President	FRED GIDDINGS	Atchison, Kan.
Secretary	GEO. W. TILLSON	Brooklyn, N. Y.
Treasurer	L. V. CHRISTY	Wilmington, Del.

Finance Committee

A. F. EGGERS, Chairman	Newark, N. J.
T. C. HATTON	Wilmington, Del.
R. H. McCORMICK	Detroit, Mich.

Executive Committee

The officers of this Society, together with the Past Presidents who have retained their continuous membership, constitute the Executive Committee. The Past Presidents are as follows:

Past Presidents

M. J. MURPHY	St. Louis, Mo.
GEO. H. BENZENBERG	Milwaukee, Wis.
AUG. HERRMANN	Cincinnati, Ohio.
HARRISON VAN DUYNE	Newark, N. J.
NELSON P. LEWIS	Brooklyn, N. Y.
A. D. THOMPSON	Peoria, Ill.
ROBERT E. McMATH	St. Louis, Mo.
E. A. FISHER	Rochester, N. Y.
C. H. RUST	Toronto, Canada.
GEO. M. BALLARD	Newark, N. J.
A. PRESCOTT FOLWELL	Easton, Pa.
CHAS. C. BROWN	Indianapolis, Ind.

STANDING COMMITTEES

Appointed by the President in accordance with Article IV, Section 4, of the Constitution of the Society.

1906-1907

Street Paving

ALLAN W. DOW, Chairman.....New York City.
WILLIAM S. CRANDALL.....New York City.
EDGAR B. KAY.....Tuscaloosa, Ala.

Electric Street Lighting

E. A. FISHER, Chairman.....Rochester, N. Y.
L. H. WEISSLEDER.....Cincinnati, O.
WILLIAM H. FLOYD, JR.....St. Joseph, Mo.

Sewerage and Sanitation

CHARLES H. RUST, Chairman.....Toronto, Ont.
EDWARD S. RANKIN.....Newark, N. J.
WILLIAM F. DAY.....Detroit, Mich.

Water Works and Water Supply

J. L. LUDLOW, Chairman.....Winston-Salem, N.C.
JOHN W. ALVORD.....Chicago, Ill.
THEO. A. LEISEN.....Wilmington, Del.

Taxation and Assessment

W. H. V. REIMER, Chairman.....East Orange, N. J.
ARTHUR R. DENMAN.....Newark, N. J.
R. W. BALL.....Henderson, Ky.

City Government and Legislation

GEORGE P. CODD, Chairman.....Detroit, Mich.
GEORGE C. EARLE.....New Orleans, La.
JULIAN GRIGGS .....Columbus, Ohio.

Disposition of Garbage and Street Cleaning

T. C. HATTON, Chairman.....Wilmington, Del.
HOWARD C. BAYLES.....New York City.
J. K. MITCHELL.....Detroit, Mich.

Municipal Franchises

R. H. McCORMICK, Chairman.....Detroit, Mich.
C. E. LEONARD.....Austin, Tex.
CHARLES C. BROWN.....Indianapolis, Ind.

Review

A. PRESCOTT FOLWELL, Chairman.....Easton, Pa.
CLARENCE D. POLLOCK.....Brooklyn, N. Y.
J. M. McCARTIN.....Birmingham, Ala.

SPECIAL COMMITTEES

Appointed by the President in accordance with resolutions adopted by the Society.

Municipal Data and Statistics

J. W. HOWARD, Chairman.....New York City.
H. W. WILMOT.....New York City.
WILLIAM FORTUNE .....Indianapolis, Ind.

Park Development and Maintenance

FREDERICK G. TODD, Chairman.....Montreal, Can.
JAMES OWEN .....Montclair, N. J.
E. A. HARPER.....Kansas City, Mo.

Fire Protection

ALCIDE CHAUSSE, Chairman.....Montreal, Can.
JOHN M. GOODELL.....New York City.
J. N. HAZELHURST.....Mobile, Ala.

Exhibits for Next Meeting

R. K. DAVIS, Chairman.....Detroit, Mich.
GEORGE W. TILLSON.....Brooklyn, N. Y.
G. M. INGRAM.....Nashville, Tenn.
A. PRESCOTT FOLWELL.....Easton, Pa.
A. J. MEAD.....Jackson, Mich.
WILLIAM F. DAY.....Detroit, Mich.

NOTICE

The Annual Reports for the former meetings are for sale by the Secretary at the following prices, including postage:

1895	$ .25	1901	$1.00
1897	1.25	1903	1.00
1898	1.25	1904	1.00
1899	1.00	1905	1.00
1900	1.00	1906	1.00

Annual Dues per Corporate Member..... $5.00
Annual Dues per Associate Member..... 10.00

Address all communications to the Secretary,

GEO. W. TILLSON,
Municipal Building,
Brooklyn, N. Y.

AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS

CONSTITUTION OF THE SOCIETY

ARTICLE I—NAME AND OBJECT.

Section 1. The objects of this Society, which shall be known as "The American Society of Municipal Improvements," shall be to disseminate information and experience upon, and to promote the best methods to be employed in the management of municipal departments, and in the construction of municipal works, by means of annual conventions, the reading and discussion of papers upon Municipal Improvements, and by social and friendly intercourse at such conventions, and to circulate among its members, by means of an annual publication, the information thus obtained.

ARTICLE II—MEMBERSHIP.

Section 1. Any municipality within America shall be eligible to membership in this Society; likewise any engineer, officer, or director who shall have charge of or supervision over or be employed as a consulting engineer on any public or municipal department work.

Any member who shall have ceased to have charge or supervision of any public or municipal department or work may retain his membership, unless he shall have come under the restrictive requirements of associate membership, when he shall retain membership as an associate only.

Sec. 2. Every application for membership shall be in writing, stating the name, location and department, if any; and, if of an individual, shall also state age, residence and position of the applicant, if any.

Sec. 3. Any proper person interested in municipal improvements or work as a contractor or contracting agent or who is a manufacturer or dealer in municipal supplies, may become an associate member, who shall enjoy all the rights and privileges of full membership, excepting that of holding office or voting.

Sec. 4. Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this Society, and his name shall be discontinued from the roll by the Secretary.

Sec. 5. Any member may withdraw from the Society upon payment of all dues to date, and by notifying the Secretary thereof in writing.

Sec. 6. Any member may be expelled from the Society upon the recommendation of the Executive Committee adopted by a two-thirds vote of all the members present.

ARTICLE III—Fees and Dues.

Section 1. Each corporate member shall pay five dollars per annum, and each associate member shall pay ten dollars per annum. All dues to be payable in advance, on or before the date of the annual meeting.

ARTICLE IV—Officers.

Section 1. The officers of this Society shall consist of a President, three Vice-Presidents, a Secretary, and a Treasurer, not more than two of whom shall be a resident of the same state, and who with the Past Presidents who have retained their continuous membership shall act as an Executive Committee for and in behalf of the Society.

Sec. 2. There shall also be elected a Finance Committee consisting of three members of the Society.

Sec. 3. In case of any of the above positions, excepting the presidency, becoming vacant, or in case of their absence during the annual convention, the President shall fill such vacancy by appointment from the membership.

Sec. 4. There shall be appointed annually the following standing committees:

1. Street-Paving.
2. Electric Street-Lighting.
3. Sewerage and Sanitation.
4. Waterworks and Water-Supply.
5. Taxation and Assessments.
6. City Government and Legislation.
7. Disposition of Garbage and Street Cleaning.
8. Review.
9. Municipal Franchises.

The number of each committee shall be three, and the Chairman may add such names as he may deem advisable. No special or standing committee shall be authorized to create any liabilities unless the same shall have been first approved by the Executive Committee.

ARTICLE V—Election.

Section 1. The officers of this Society shall be elected by ballot on the second day of each annual convention, and each municipality shall be entitled to as many votes as it has representatives present.

Sec. 2. The President shall not be eligible for immediate re-election (except by a unanimous vote).

Sec. 3. The officers elected shall assume office immediately after the close of the annual meeting at which they were elected.

Sec. 4. The ballot for any officer may be waived by unanimous consent.

ARTICLE VI—DUTIES.

Section 1. The President shall preside at the meetings of the Society and at those of the Executive Committee, and shall perform such other duties as are incumbent upon the office. In the absence of the President, or upon his becoming ineligible, the senior Vice-President shall assume and perform the duties of the office.

Sec. 2. The Secretary shall keep accurate minutes of the proceedings of the Society and of the Executive Committee; shall conduct all correspondence; shall issue notices of any meeting of the Society not less than four weeks prior to the date of such meeting; shall collect and receipt for all fees and dues and pay them to the Treasurer quarterly, taking his receipt for the same; and keep accurate account between the Society and its members.

Sec. 3. The Treasurer shall receive from the Secretary and safely keep all moneys belonging to the Society, giving his receipt therefor; shall pay all bills approved by the Finance Committee or the President; shall keep correct account of the funds of the Society, and submit to it at its annual meeting a report of all receipts and disbursements during the preceding year.

Sec. 4. The Executive Committee shall manage all the affairs of the Society, subject to the action and approval of the Society at its meeting. All questions in Executive Committee shall be decided by a majority vote, and five members shall constitute a quorum, not less than four of whom shall be officers of the Society. The Executive Committee shall meet at least once each year, on the morning of the first day of the annual meeting of the Society, and as much oftener as the President may determine. The Executive Committee shall be directed to keep an accurate list of the members of the Society, and to ascertain from time to time whether or not such members are still municipal officers, and if not, to take such steps as may be necessary to secure new members from such cities in which members of the Society are no longer municipal officers—this with a view of insuring the permanency of the association, as well as maintaining and increasing the membership thereof.

Sec. 5. The Finance Committee shall meet on the morning of the first day, and previous to the annual meeting of the Society, to examine and audit the Secretary's and Treasurer's accounts and annual statements, and report thereon to the Society.

Sec. 6. It shall be the duty of the Chairman of each standing committee to prepare a report, with the aid of his fellow-committeemen, and submit the same at the annual meeting.

Sec. 7. One afternoon, and such other time as may be deemed necessary, shall be devoted to sectional work, the Chairman of each standing committee acting as Chairman of the section. The Chairman of each section shall arrange the program of the sectional meetings in connection with the Program Committee of the Society.

ARTICLE VII—Meetings.

Section 1. The annual meeting of the Society shall be held on the second Tuesday in October of each year, in such city as the majority of the members voting shall decide. Selection of place of meeting to be made after the officers shall have been elected. Provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2.

Sec. 2. At any annual meeting of the Society twenty members shall constitute a quorum for the transaction of business.

Sec. 3. Any member, with the concurrence of the presiding officer, may admit friends to the meeting of the Society, but such person or persons shall not without the consent of the meeting be permitted to take part in any discussion.

Sec. 4. All papers, drawings, etc., submitted to the meeting of the Society shall be and remain the property of the Society.

ARTICLE VIII—Order of Business.

Section 1. At the annual meeting of the Society the order of business shall be as follows:

1. Roll call.
2. Reading of minutes of last meeting.
3. Considering of applications for membership.
4. The President's address.
5. Reports of the Secretary and Treasurer.
6. Report of the Executive Committee.
7. Report of the Finance Committee.
8. Report of special committees.
9. Reading and discussion of papers.
10. Election of officers.
11. Selection next place of meeting.
12. General business.

Sec. 2. All questions shall be decided by vote, and all differences of opinion in regard to points of order shall be settled by parliamentary practice as set forth in Cushing's Manual.

ARTICLE IX—Amendments.

Section 1. The foregoing constitution and articles may be amended on or after the second day of any annual meeting of the Society by a two-thirds vote of all members voting; provided such proposed amendment shall have been submitted to the Society in writing on the first day of its annual meeting.

BY-LAWS

No. 1. Members shall not be permitted to give out for publication any papers, to be submitted to the Society at its annual meeting, in advance of such meetings; and all requests for papers for such purposes shall be referred to the Secretary.

No. 2. All committees and members of the Society shall be required to furnish four copies of all reports, papers or other matters submitted to the Society for its consideration.

No. 3. It shall be the duty of the President, on or before the 1st day of January of each year, to divide America by States into Territorial Sections, and to assign one or more members of the Executive Committee to each of said sections. It shall be the duty of the members of the Executive Committee thus assigned to keep an accurate list of the municipalities and members of the Society in the particular territory assigned to them, and to ascertain, from time to time, whether or not the members of the Society from the territory assigned to them are still municipal officers; and when not, to take such steps as may be necessary to secure new members from such municipalities, as well as to secure membership in the Society of such municipalities and officials in the territory assigned to them that have not acquired the same in the past.

No. 4. The President shall be required, at least sixty days before the holding of the annual convention, to communicate with the local committee having charge of the arrangements of the convention in the city in which the same is to be held, with a view of securing exact data as to place of meeting, entertainment to be furnished, hotel and railroad rates, etc., and to print this information, together with such data relating to the business of the convention as he may have, and turn the same over to the Secretary, or members of the Executive Committee, for distribution.

LIST OF MEMBERS

Corporate Members

Ackerman, J. Walter, City Engineer, Auburn, N. Y.
Allen, C. R., Jr., City Engineer, Barre, Vt.
Allin, Thos. D., 72 N. Fair Oaks Ave., Pasadena, Cal.
Alvord, John W., Consulting Engineer, 127 Hartford Bldg., Chicago, Ill.
Anderson, L. W., City Engineer, Grand Rapids, Mich.
Andrews, Horace, 125 Lancaster St., Albany, N. Y.
Arthur, William H., Superintendent of Public Works, Stamford, Conn.

Baker, Henry E., City Engineer, Watertown, N. Y.
Ball, R. W., City Engineer, Henderson, Ky.
Barlow, John R., City Engineer, Montreal, Canada.
Barr, J. Carroll, Economy, Pa.
Barrow, E. S., City Engineer, Hamilton, Ont.
Bauman C. V., Street Committee, Newark, N. J.
Bayles, Howard G., Consulting Engineer, 37 W. 34th St., New York City.
Benzenberg, Geo. H., Consulting Engineer, 436 Jefferson St., Milwaukee, Wis.
Berry, George, Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Blair, Bryce R., City Engineer, Carbondale, Pa.
Bock, Frank J., Board of Public Works, Newark, N. J.
Boley, C. U., City Engineer, Sheboygan, Wis.
Bragg, Harry, Editor Canadian Municipal Journal, Montreal, Canada.
Breen, J. E., Chief Engineer, Board of Public Service, Cincinnati, O.
Briggs, B. E., City Engineer, Erie, Pa.
Brown, Charles C., Editor Municipal Engineering, Indianapolis, Ind.
Brown, C. W., City Clerk, Winnipeg, Man.

Cappelen, F. W., 702 Oneida Block, Minneapolis, Minn.
Carpenter, George A., City Engineer, Pawtucket, R. I.
Case, E. W., City Engineer, Colorado Springs, Colo.
Chairman of Municipal Council, St. Johns, Newfoundland.
Chausse, Alcide, Building Inspector, Montreal, Can.
Christy, L. V., Secretary Street and Sewer Dept., Wilmington, Del
Clark, Alfred, Commissioner of Highways, Concord, N. H.
Crandall, Wm. S., Room 420, 253 Broadway, New York City.
Codd, George P., Mayor, Detroit, Mich.
Codwise, Edward B., City Engineer, Kingston, N. Y.

Dalton, E. L., City Engineer, Dallas, Texas.
Dalrymple, F. W., City Engineer, Bayonne, N. J.
Day, William F., Engineer in Charge of Sewers, Detroit, Mich.
Denman, A. R., Board of Public Works, Newark, N. J.
Dow, A. W., Consulting Chemist, 120 E. 23d St., New York City.

Earle, Geo. G., Gen'l Supt. Sewerage and Water Board, New Orleans, La.
Easby, Wm. Jr., Asst. Professor of Civil Engineering, College Hall, University of Pennsylvania, Phildelphia, Pa.
Eggers, Augustus F., Board of Works, Newark, N. J.

Fisher, E. A., City Engineer, Rochester, N. Y.
Floyd, William H., Jr., City Engineer, St. Joseph, Mo.
Folwell, A. Prescott, Consulting Engineer, Easton, Pa.
Fort, E. J., Assistant Engineer, Bureau of Sewers, Borough of Brooklyn, N. Y.
Fortune, Wm., Publisher Municipal Engineering, Indianapolis, Ind.
Freiberg, M. J., Waterworks Commission, 216 E. Front St., Cincinnati, O.
Freshney, S. A., Secretary and General Manager, Board of Public Works, Grand Rapids, Mich.
Fuller, George W., Consulting Engineer, 170 Broadway, New York City.

Gainey, W. H., City Engineer, Valdosta, Ga.
Giddings, Fred, City Engineer, Atchison, Kan.
Gilchrist, Allen R., City Engineer, Montgomery, Ala.
Glore, W. H., Superintendent Waterworks, Covington, Ky.
Goodell John M., Editor Engineering Record, 114 Liberty St., New York.
Greathead, Wm. E., Clerk Board of Public Works, Newark, N. J.
Griffith, John E., Assistant Engineer, Dep't of Water Supply, Borough of Brooklyn, N. Y.
Griggs, Julian, Scioto Valley Traction Co., Columbus, O.
Grosser, Hugo S., City Statistician, 207 City Hall, Chicago, Ill.

Hamell, J. M., City Engineer, Hull, Que.
Harper, E. A., City Engineer, Kansas City, Mo.
Hatton, T. Chalkly, Engineer Street and Sewer Dept., Wilmington, Del.
Hazelhurst, J. N., Engineer Board of Public Works, Mobile, Ala.
Henry, P. W., Consulting Engineer, 17 Battery Place., New York City.
Herrman, August, President Waterworks Commissioners, Cincinnati, O.
Hinds, Frank A., Consulting Engineer, Watertown, N. Y.
Holloway, C. M., Waterworks Commissioner, Cincinnati, O.
Howard, J. W., Consulting Engineer, No. 1 Broadway, New York, N. Y.
Howe, W. B., City Engineer, Concord, N. H.

Johnson, Edward J., City Engineer, Nashua, N. H.
Johnston, A. L., Sewer Department, Wilmington, Del.
Jones, John, Superintendent of Streets, Toronto, Ont
Judson, William Pierson, Broadalpin, Fulton Co., N. Y.

Kay, Prof. Edward B., University of Alabama, Tuscaloosa, Ala.
Kendrick, Julian, City Engineer, Birmingham, Ala.
Ker, N. I., City Engineer, Ottawa, Can.
Kummer, F. J., General Manager U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.

Leisen, Theo. A., Wilmington, Del.
Leonard, C. E., City Engineer, Austin, Texas.
Lewis, N. P., Chief Engineer Board of Estimate and Apportionment, New York City.
Ludlow, J. L., Consulting Engineer, Winston-Salem, N. C.
Luster, W. H., City Surveyor, Elizabeth, N. J.

McCartin, J. M., Street Commissioner, Birmingham, Ala.
McClintock, John N., Consulting Engineer, 45 Milk St., Boston, Mass.
McCormick, R. H., City Engineer, Detroit, Mich.
McMath, Robert E., 327-328 Lincoln Trust Bldg., St. Louis, Mo.
McMillan, Chas., City Clerk, Calgary, Canada.
Magley, Wm., Board of Public Service, Cincinnati, O.
Markbreit, L., Waterworks Commission, Cincinnati, O.
Mead, D. W., 605 First National Bank Bldg., Chicago, Ill.
Meade, R. E., Consulting Engineer, 1520 Brown-Marx Building, Birmingham, Ala.
Melvin, T. H., Sewer Dept., Wilmington, Del.
Minshall, Frederick, Consulting Engineer, Abbeville, S. C.
Mitchell, J. K., Asst. City Engineer in Charge of Sewers, Detroit, Mich.
Monie, John M., Municipal Engineer, Bonne Terre, Mo.
Murphy, F. E., Supt. of Streets and Waterworks, Huntsville, Ala.

Nelson, John A., City Engineer, Mitchell, S. D.
Neville, Thos., Deputy Commissioner of Public Works, Rochester, N. Y.

O'Brien, F. J., 112 W. Bridge St., Oswego, N. Y.
Owen, Jas., Consulting Engineer, 196 Market St., Newark, N. J.

Parent, Arthur, Supt. City Lighting Dept., Montreal, Canada.
Parker, G. A., Superintendent Keney Park, Hartford, Conn.
Parkes, William J., City Engineer, Pine Bluff, Ark.
Phillips, Geo., Board of Public Works, Newark, N. J.
Phinney, F. J., Superintendent Water Works, Rockford, Ill.
Pollock, Clarence D., Assistant Engineer Bureau of Highways, Brooklyn, N. Y.
Potter, W. G., City Engineer, Greensboro, N. C.
Provost, A. J., Jr., 518 Fifth Ave., New York.
Provost, Peter, Chief Fire Dept., Ottawa, Canada.

Rankine, E. S., Engineer Sewer Department, Newark, N. J.
Reed, Alex., U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.

Reichardt, Walter F., Assistant City Engineer, Little Rock, Ark.
Reimer, W. H. V., City Engineer, East Orange, N. J.
Reiter, George W., City Engineer, Salt Lake City, Utah.
Rommel, Geo., Jr., Engineer Street and Sewer Dept., Wilmington, Del.
Rust, Chas. H., City Engineer, Toronto, Ont.
Ruttan, H. N., City Engineer, Winnipeg, Manitoba.

Sanderson, H., Alderman, Winnipeg, Man.
Schmidt, Jacob, Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Sheridan, John C., Assistant Engineer, Bureau of Highways, Borough of Brookyln, N. Y.
Sherrerd, M. R., Superintendent Waterworks, Newark, N. J.
Shipman, Charles M., Gen'l Supt. of Works, Newark, N. J.
Smith, Wright, Chief Engineer, Board of Public Works, Mobile, Ala.
Solotaroff, William, Supt. Shade Tree Commission, East Orange, N. J.
Strachan, Joseph, Assistant Engineer, Bureau of Highways, Borough of Brookyln, N. Y.
Stewart, Wm. J., First Assistant City Engineer, Rochester, N. Y.
Stobaeus, J. B., 160 Clifford St., Newark, N. J.

Talbot, A. N., Professor of Civil Engineering, University of Illinois, Urbana, Ill.
Taubenheim, Ulrich E., Manager City Waterworks, Archangel, Russia.
Thompson, A. D., 304 Masonic Temple, Peoria, Ill.
Thompson, S. C., Prin. Asst. Engineer Bureau of Highways, Borough of Bronx, New York.
Tillson, Geo. W., Chief Engineer, Bureau of Highways, Brooklyn, N. Y.
Todd, Fred. G., Landscape Architect, Montreal, Canada.

Vinson, J. S., Board of Public Works, Newark, N. J.
Vrooman, Morrell, City Engineer, Gloversville, N. Y.

Watson, George S., 54 Baxter Building, Philadelphia, Pa.
Wheeler, Holland, City Engineer, Lawrence, Kan.
Whipple, George C., Consulting Engineer and Sanitary Expert, 220 Broadway, N. Y.
Weissleder, L. H., Consulting Engineer, with the Cincinnati and Suburban Bell Telephone Co., Cincinnati, Ohio.
Wilmot, H. W., Expert Accountant, 54 William St., New York City.
Wilson, W. M. City Engineer, Gadsden, Ala.
Wingfield, Nisbet, City Engineer and Com. of Public Works, Augusta, Ga.
Wright, Francis H., City Engineer, Helena, Ark.

Associate Members

A. L. Barber Asphalt Co., 17 Battery Place, New York City.
Adler, Arthur A., 804 Chamber of Commerce, Chicago, Ill.

Bangham, Richard, Ontario Asphalt Block Co., Windsor, Ont.
Barrett, Manufacturing Co., 17 Battery Place, New York City.
Beck, H. N., Mgr. Canada Fire Hose Co., 14 St. Sacrament St., Montreal, Canada.
Blair, F. N., President Blair Light Co., Northboro, Mass.
Buff, Lewis F., Asst. Treas. Buff & Buff Mfg. Co., Jamaica Plains, Boston, Mass.
Buffalo Steam Roller Co., Buffalo, N. Y.

Cameron, Hugh, Agent Waterous Engine Co., 72 Queen St. W., Toronto, Canada.
Clements, L. L., U. S. Wood Preserving Co., Mercantile Library Bldg., Cincinnati, Ohio.
Coburn, H. P., General Manager, Sawyer & Massey Co., Hamilton, Ont.
Cochrane, D. J., Sicily Asphaltum Paving Co., Montreal, Canada.
Colas, Jules, Mfr. of steel gullies, 6 St. Denis St., Montreal Canada.

Davis, Robert K., Hammond Bldg., Detroit, Mich.
Decarie, F. L., Chief Engineer, Decarie Mfg. Co., Minneapolis, Minn.
Dill, Charles W., Manager Constructing & Paving Co., Toronto, Ont.
Donaldson, John, Southern Bitulithic Paving Co., Birmingham, Ala.
Drummond, T. J., President Montreal Pipe Foundry Company, Vice-President Montreal Water & Power Co., Montreal, Canada.

Ellis, Geo. V., President Ellis Company, 216 W. 23rd St., New York City, N. Y.
Engstfeld, G. C., Southern Paving & Construction Co., Birmingham, Ala.

Folger, M., President, Thompson Meter Co., Brooklyn, N. Y.
Folkes, E. C. E., Manager Wilkinson Plough Co., Toronto, Can.
Fuller, H. J., President, Canadian Fairbanks Co., Montreal, Can.

Hutchinson, F. S., 17 Battery Place, New York City.

Ingram, G. M., 81 N. Cherry Street, Nashville, Tenn.
Irwin, A. B., Sec. and Treas. Pacific Coast Pipe Company, 1551 Granville Street, Vancouver, B. C.

Lasley, T. H., Vice-President Southern Clay Mfg. Co., Chattanooga, Tenn.
Lasley, W. M., President Southern Clay Mfg. Co., Chattanooga, Tenn.

McEvoy, John G., Secretary and General Manager McEvoy Vit. Brick Co., 1345 Arch Street, Philadelphia, Pa.
Martin Harry K., Fire Appliances; Street Railway Chambers, Montreal, Can.
Mead, A. J., Reinforced Concrete Pipe Co., Jackson, Mich.
Morrison, James, President James Morrison Brass Mfg. Co., Toronto, Ont.

Morrison, T. A., 204 St. James St., Montreal, Can.
Mussen, W. H. C., 299 St. James Street, Montreal, Can.

Parker, R. H., Southern Clay Mfg. Co., Chattanooga, Tenn.
Pittsburg Filter Company, Pittsburg, Pa.
Pough, F. H., Sewer Cement Manufacturer, 28 Burling Slip, New York City.

Reinforced Concrete Pipe Co., Jackson, Mich.
Rock, J. C., 17 Battery Place, New York City.
Root, John M., General Manager Decarie Manfg. Co., Minneapolis, Minn.

Scholl, Julian, 126 Liberty Street, New York, N. Y.
Southern Cement Co., Birmingham, Ala.
Strain, Jas. H., Road Rollers and Road Machinery, 254 East Twenty-first St., Brooklyn, N. Y.

Tenney, George O., President Atlantic Bitulithic Paving Co., Spartanburg, S. C.
Trudel, Tancrede, 107 Bleury Street, Montreal, Can.

Warren, Geo. C., 93 Federal Street, Boston, Mass.
Warren, Ralph, 93 Federal St., Boston, Mass.
Wertz, J. L., Vice President Neptune Meter Co., 120 Liberty Street, New York, N. Y.
White, W. W., Reinforced Concrete Pipe Co., Jackson, Mich.
Wilson, John A., 902 First National Bank Bldg, Nashville, Tenn.
Wood, R. D. & Company, Waterworks Supplies, 400 Chestnut St., Philadelphia, Pa.
Wunder, F. A., Iroquois Iron Works, Buffalo, N. Y.
Wyllie, H. D., General Manager Cameron Septic Tank Co., 812 Monadnock Block, Chicago, Ill.

NEW YORK, October 17th, 1905.

Mr. Geo. W. Tillson, Sec'y American Society of Municipal Improvements, Room 12, Municipal Bldg., Brooklyn, N. Y.

DEAR SIR: It is the hope of the Board of Directors of the American Society of Civil Engineers that its cordial relations with other associations of engineers be maintained and if possible strengthened.

I am therefore directed to say that the Society will always be glad to receive visits from your members; that its Reading Room and Library are open to them; and that their presence at any of its professional meetings (which are held at 8:30 P. M. on the first and third Wednesdays of each month, with the exception of July and August) will be most heartily welcome.

Trusting that you will inform the membership of your Society that this is the case, and that we shall have the pleasure of receiving such of them as may find it convenient when in New York, I am

Yours faithfully,

CHAS. WARREN HUNT,
Secretary.

THIRTEENTH ANNUAL CONVENTION

OF THE

American Society of Municipal Improvements

THE PRESIDENT: The Convention will now come to order. I have the pleasure of introducing to you Mr. Henry Gray, who is the the Lieutenant Governor-elect of the State of Alabama, who will welcome us to the city and the state. (Applause.)

MR. HENRY GRAY: Mr. Chairman, Ladies and Gentlemen: I trust that when I appear here in the position of a substitute for our distinguished Mayor, Mr. George Ward, who had business out of the city today, that you will not think your welcome to Birmingham is less cordial or less hearty than if he had extended it himself.

During the past year, or during the present year, it has been the pleasure of Birmingham to have within its midst a great many distinguished bodies. First we had the Medical Society of the State of Alabama. Then we had the conference of the Methodist Churches of the United States, with some thirty or forty distinguished bishops; and then we have had since that time the teachers of the State of Alabama. But, I do not believe that during the year we have had a body whose aim and whose object is worth more to the people of this city and of this state, and of the cities that they represent, and from which they came, than the distinguished body which presents itself to us today. (Applause.)

Birmingham is a new town, and started within the memory of a great many of you who are present here today, and it owes a great deal to the distinguished engineer, a man who I know it is your pleasure, as well as ours, to honor, Col. Geo. E. Waring, Jr., formerly of New York, who laid out the system of sewerage for this city. Coming as you do, a great majority from distant states, you probably are not familiar with our community or our state. Alabama first in the sisterhood of states, is first in almost everything. I certainly feel that we are first in our welcome to all of you who are here today, and I trust that your visit here will be fraught with interest and benefit to you as well as of interest and benefit to ourselves. What we are doing I believe is along the line of municipal improvements, so far as the City of Birmingham is concerned. We are attempting to build a city that will in the future reflect

credit upon those of us who are gone and who left matters easy for those who are to follow. I trust that your visit here will be of benefit to you, and that it will be of interest to you, and that it will be of benefit and interest to our good people.

I want to say that the keys of the City of Birmingham are now turned over to you, and if you should happen to get locked up, we will endeavor to have the keys taken by some one and have you unlocked. (Applause.)

THE PRESIDENT: Gentlemen, we have the honor and pleasure of now listening to Mr. J. L. Parker, who represents the Commercial Club, of Birmingham (Applause.)

MR. CHAIRMAN, LADIES AND GENTLEMEN: It is a very bad thing at least to be last. The proper thing for me to have done would have been to explain to you and to have told you who the distinguished gentleman was who has just addressed you. He is evidently not a stranger to us, and he is not a stranger to the greater part of the United States. We are proud of him ourselves, for he has done a great deal to help develop this great district of ours. We are a young city, and we have a still younger district, and this district has been developed by young men, men who are not babies in intellect or energy. The whole commercial interests of Birmingham depend upon the development, not only of the city, but the entire community, and on behalf of the club that I represent, the Commercial Club, I welcome you to Birmingham, and to the advantages of our club; and I hope that you will leave us feeling that you have not only had a good time, but that you will see something and will tell to the world the wonderful things that you see and what we propose to show you throughout this district. (Applause.)

THE PRESIDENT: I do not know that there is very much that I can say, except to thank the gentlemen for the hospitality which they have so cordially offered us, and also to thank the local committee for the excellent program which they have prepared in the way of showing us what Birmingham is like.

I have been traveling back and forth across the South for a few days on my way here, and I must say that I have been very much impressed with the resources which this country has. It is really the first time I have ever had the opportunity to find out what there is here We have the history of it, which came to us in the North, but it is very much better for us to see it, and even in the short time it takes us to come here, we can see that you have great things in store. I have been in several cities on the

way, both Northern and Southern cities, and I must say that Birmingham is a handsome city, the handsomest I have seen in the South. I believe we will have a good time while we are here, and I believe we will see some things which will be of great interest to us, and we will leave here with a great addition to our store of knowledge, and we will try to reciprocate in the best way we can, in our good conduct while we are here, and the papers and discussions which we will try to offer. (Applause.)

THE PRESIDENT: We will now proceed with the regular order of business. I believe it is customary to dispense with the roll call and the reading of the minutes of the last meeting. And the consideration of membership will also be postponed until a later day, because new members are coming in, and they are not all here yet. The next order of business, I believe, is the President's address.

PRESIDENT'S ADDRESS.

The President's address in a society of this sort is very frequently a perfunctory review of the progress of the year, or in some branch of the work covered by the society. With us this duty is very much better performed by the Committee on Review, which spends a year getting its information together, and has two or three engaged upon its report. The achievements of the Society itself, the history of its efforts, have been quite fully set forth in several Presidents' addresses and papers before this and other societies, one of which I had the honor to prepare for the civic week at the St. Louis Exposition. An address on this subject would also be guilty of repetition of material already familiar to us all. The future of the Society is a subject which has not been over-elaborated, and is one that may be made fresh as it is largely a matter of imagination. While there may be many differences of statements of our past history, which are largely due to our imaginations, these statements have a common basis and cannot get far from it in form at least.

Our ideas regarding the future have only one point in common, the starting point, the condition of the Society at the present time. Papers on the future of the Society depend for their interest upon the quality of the product of the author's imagination. While I cannot hope to give you anything of absorbing interest, there is a subject in which I am personally much interested and in which I would like to interest you if I could. It has already been presented in part to some of the Society, and in papers before other societies, but thus far, with but little result. I will make my statement of it as brief as possible. First, the starting point must be fixed, the present condition of the Society and its tendencies.

Beginning with the administration of the municipal departments to which the construction and operation of public works are entrusted, the Society has emphasized this selection of a field for its activities, and while retaining in its membership the mayors, members of boards and councilmen who are the business heads of the departments, its papers and discussions have been largely in the hands of the technical experts, having the design and construction of works in their charge.

This has been desired by the heads of the departments and the engineers have done the work in the Society which has thus been assigned to them, with pleasure and profit to themselves and others within and without the Society. The published volumes of proceedings which the report of the present convention will make the twelfth and the best collections of papers, data, and discussions on municipal improvement questions which can be found anywhere. These volumes show from year to year the advancement which has been made in methods, materials and results and have usually been slightly in advance of the procession. The good new things have been recognized by the acknowledged experts among the members, and their announcement or indorsement of these improvements has led to their adoption by other cities.

The benefits of the Society have been restricted too much to its own membership. Progressive municipal officers have recognized the value of membership in the Society, and many have been induced to join on account of the valuable character of the proceedings. It is the fact, however, that the knowledge of the value of the Society is not widespread, that many officials do not know of its existence, that many others know it only by name, and that a goodly number of those who see what the value of such a Society might be have taken the trouble to find out whether the Society fills the bill. Some city officials, as well as newspaper men, call the trip to the convention a junket, knowing that many such trips may be so classified, but not knowing the difference in the qualities of societies and their memberships. But there is a still larger number of people who need to know what this Society can tell them but are not eligible to membership because they cannot reciprocate in kind for the benefit they may receive.

Some of these persons selected from our best citizens, the most progressive and public spirited have formed themselves into a society for the study of municipal problems and are doing careful and often most valuable work upon them. They need the information about principles and methods in many lines which the discussions in the Society would give them. They need to feel the spirit that pervades this Society, which they cannot get from reading its proceedings. They must be present and participate in its deliberations to be able to appreciate its character and the aspirations of its members.

But few of the members of the societies referred to are interested in subjects enough to lead them to attend our convention, as at present fixed in time and place, even if they did not feel that they were intruding,

since they cannot become members. But they feel the lack of what they know we can give them. More, than this, they recognize that we are working for the same end as themselves—the improvement of municipalities—and recognize what we should recognize also, the co-operation in the good work we are attempting to perform will hasten its successful attainment. It is not surprising, therefore, that they have made overtures for some sort of a combination or correlation.

At our Rochester convention a proposition was made to combine the half dozen or so societies, which, by certain combinations, had been reduced to four, our own Society, the League of American Municipalities, The American Civic Association, The National Municipal League. This proposition, I believe, did not get beyond the Board of Directors, because it seemed to be the unanimous opinion of the members of that body that such a combination would not be advantageous to any of the societies, and certainly not to our own. I made the suggestion at that time that a closer relation, such as that existing between the Association for the Advancement of Science and its affiliated societies might be accepted and this was elaborated on later and an alternative offered if even this bond were irksome. This substitute provided that only the various societies should have the same place of meeting and the times should be chosen so as to be convenient for those who wished to attend more than one convention, all meetings possibly, during the same week, but beginning and ending on different days. The proposition met with some favor, and I have in my hands letters from the American Civic Association and the National Municipal League, asking what can be done towards fixing a common place of meeting of the two societies and our own. I say nothing of the fourth society, because nothing has been heard from them, and the lack of co-operation between that society and our own, when they met during the same week in St. Louis, and East St. Louis, makes it seem improbable that this Society would care to join this movement at this time.

I am fully aware that this Society took little or no interest as a body in the success of the civic week which was held in St. Louis during the same week that our convention was held there, under the auspices of the National Municipal League and American Civic League, but that no interest was manifested at that time is no reason why interest should not be shown now, and it is the purpose of this paper to make another attempt to arouse such interest. There are none of the objections to this proposition which were advanced with reference to that brought up at Rochester. There can be no interference to the work of the organization of this Society. We have an opportunity to extend the influence of our Society without effort on our part aside from that of the committee having charge of the adjustment of time and place. If we are not so wrapped up in ourselves that we can see no one else whom we can aid we can hardly afford to refuse this opportunity. And this does not take into account the benefit which many of us can derive from the other societies and "all for one price of admission."

I might elaborate upon the subject still further, but will refrain, and only ask, What shall we do about it? My own suggestion would be that when the time and place of meeting are voted upon, instructions be given the Board of Directors to take up the matter with the two societies making overtures that they be given the power to make such changes in time and place as may be found necessary.

THE PRESIDENT: I believe the next order of business is the reading of the report of the Secretary .

REPORT OF THE SECRETARY.

BROOKLYN, N. Y., October 1, 1906.

American Society of Municipal Improvements:

GENTLEMEN: I herewith submit my report for the year ending Sept. 30, 1906:

Receipts—

Dues	$835.25
Sale of Reports	42.50
Advertisements	236.65
Cash in hands of Secretary, Sept. 5, 1905	6.00
Total	$1,120.40

Paid to Treasurer—

1905.	
September 7	$542.00
November 13	35.00
December 13	75.00
1906.	
January 9	50.25
February 26	41.00
May 1	73.50
May 23	91.00
August 1	58.65
August 17	61.00
September 7	38.75
September 29	44.50
Cash on hand	9.75
Total	$1,120.40

The expenses of the office for the year have been:

Montreal Convention Expenses	$7.00
Freight and Express	12.00
Postage	16.44

Printing	13.75
Sundries	4.65
Total	$53.84

The regular routine work of the office, and the correspondence has been attended to as required.

The following changes in membership have occurred during the year:

Elected September 5th		87
Dropped for non-payment of dues	14	
Resigned	6	
Died	1	—21
Net increase		66

Making the present membership of the Society 170, of whom 122 are corporate, and 48 associate members.

The member who died was Mr. George M. Ballard, of Newark, N. J. He was President of the Society in 1904, and died December 5, 1905.

The Secretary herewith expresses his thanks to all the officials of the Society for their hearty co-operation during the year.

Respectfully submitted,

GEO. W. TILLSON,
Secretary.

(Correct.)
AUGUSTUS F. EGGERS,
FRED GIDDINGS,
Finance Committee.

THE PRESIDENT: Gentlemen, you have heard the report of the Secretary read, what will the convention do with the report of the Secretary?

It was moved by Mr. Hatton, and duly seconded, that the report be accepted and spread upon the minutes of the convention.

THE PRESIDENT: The next order of business, I believe, is the report of the Treasurer. The Treasurer, I understand, is unable to be here, and has sent his report by mail, and it is expected in the morning, and that will have to be postponed until it reaches us.

THE PRESIDENT: There is no report of the Executive Committee, and the report of the Finance Committee will have to be postponed until after the Treasurer's report is received.

THE PRESIDENT: The list of papers will now be taken up as given in the program, on page 46. The report of the Committee on Exhibits will also be postponed until this evening, at which time Mr. Davis will have some interesting announcements to make

I have a letter from Mr. Grosser, or rather his assistant, on the Committee of Statistics, dated October 4, 1906, which I will read:

Mr. Chas. C. Brown, Editor Municipal Engineering, Indianapolis, Ind.:

DEAR SIR: Mr. Grosser has requested me to write to you in answer to your letter of October the 2d. Mr. Grosser is sick at home, and has not been in the office this week, presumably the effect of overwork in connection with the convention of the League of American Municipalities. It is very improbable that Mr. Grosser will attend the convention at Birmingham under the circumstances. He has as yet not prepared the committee report, but hopes to recuperate sufficiently to do so in time for the convention.

Very respectfully yours,
FREDERICK REX,
Assistant City Statistician.

THE PRESIDENT: The next is the report of the Committee on Fire Protection.

THE SECRETARY: Mr. Chausse is not present, and I have his report, but it is a very long paper, and I think it would be well that it be incorporated in the minutes within being read.

THE PRESIDENT: I think this would be the best way to take care of the report. The paper or report of his committee is one on "Standard Threads for Fire Hose and Hydrant Couplings."

REPORT OF THE COMMITTEE ON FIRE PROTECTION.

MONTREAL, CAN., September 15, 1906.

MR. PRESIDENT AND GENTLEMEN: Your Committee on Fire Protection has to report that the question of "Standard Hose Couplings and Hydrant Fittings for Public Fire Service" having already been gone through by the National Fire Protection Association, of which the report is attached to this communication, together with two letters from Mr. F. W. Griswold, on the same subject, suggest that these communications be considered as forming part of this committee's report and entered in the proceedings of this convention.

ALCIDE CHAUSSE,
Chairman Committee on Fire Protection.

NATIONAL FIRE PROTECTION ASSOCIATION.

COMMITTEE ON HOSE COUPLINGS.

RICHMOND, VA., August 30, 1906.

M. Alcide Chausse, Building Inspector, Montreal, Can.:

MY DEAR SIR: I am advised by Mr. George W. Tillson, Secretary of the American Society of Municipal Improvements, that you are the chairman of its Committee on Fire Protection, and I beg now to address you upon a subject which appears to me of the utmost importance for the consideration of an association such as yours, and in this, I refer to the matter of standardizing hose and hydrant couplings for public fire service, and it seems to me that amongst all utilities coming under the control of municipal authorities there is none which has had less deserved attention than this very important one; and it therefore seems to me that it is almost unnecessary to more than call your attention to the conditions as they exist.

I question whether I can make more plain to you the position in which the association represented by myself stands in regard to this matter, than by enclosing herewith a carbon copy of a letter on this subject written to your Mr. Tillson some days ago and by supplementing same with a copy of our association's circular, descriptive and illustrative of the national standard hydrant and hose couplings, which I trust, my dear sir, may have your careful thought and consideration, in the hope that through your very valuable co-operation the day may be hastened when any community may be enabled to render aid to its neighbors when called upon in time of emergency with an assurance that such well-intended effort to assist will meet with success, where under present experience the efforts of outside organizations to render aid to neighboring communities has generrally proven futile, from the lack of harmony in the devices and utilities in use, the principal trouble arising on account of variations in hydrant and hose thread couplings.

Extending my apologies for approaching you in this matter without a more intimate acquaintance than that suggested by the Secretary of your Association, I trust that my plea in behalf of securing your earnest co-operation in the matter under consideration may be none the less successful, and that it may be my pleasure to hear from you at your convenience in expression of your opinion in regard to this very important matter, in anticipation of which, I beg to be, my dear sir,

Yours very truly,

F. M. GRISWOLD,
Chairman.

NATIONAL FIRE PROTECTION ASSOCIATION.

NEW YORK, August 14, 1906.

American Society for Municipal Improvement, Municipal Building, Brooklyn, N. Y., Mr. Geo. W. Tillson, Secretary:

DEAR SIR: Noticing the published announcement of the Annual Convention of your Association, to be held at Birmingham, Ala., during October, 1906, I am moved to address you in relation to a subject of such wide importance to all municipalities as to warrant the assumption that action upon it in approval simply awaits its introduction to the attention of your honorable body, and in explanation of this assumption, beg to submit for your information and consideration the enclosed circular illustrative and descriptive of the "National Standard" hose and hydrant coupling, which has been adopted by all of the prominent organizations and associations having charge and control of fire department appliances and utilities throughout the country.

In presenting this matter for consideration of your Association, it is desired to make plain the fact that we are moved by no other incentive than the conservation of the public welfare in the line of protection against loss of life and property through fires and conflagrations which may pass beyond control of any local organization, and which therefore necessitate calls for assistance from neighboring cities or communities in the time of peril, as has been so frequently demonstrated in the sweeping fire in various cities of the country during the past two or three years.

It is needless, perhaps, to remind any member of your Association of the fact that in many instances of conflagration it has been found impossible to utilize the apparatus of such outside organizations as may respond for the call for help, however willingly such service may have been tendered, and this simply from the fact that the appliances of such apparatus as comes to aid, do not interchange with those in use by the department seeking assistance, and that practically all of such troubles are to be found in the lack of uniformity in hose and hydrant couplings.

Hence, it appears to this committee that no more urgently important matter could be brought before your Association than that of the endorsement and approval of the standard hose and hydrant couplings and their adoption, to the end that by such uniformity it becomes possible for each municipality or community to be assured of efficient aid from its neighbor when necessity demands calling for its assistance to check the spread of a disastrous fire. We, therefore, appeal to your Association to give this matter its most careful consideration, expressing the hope that its action may afford added proof of that broad comprehension and wise judgment which seeks the accomplishment of the betterment of conditions in relation to the safety of life and property throughout the country, and that to this end your honorable Association may endorse and approve this very essential element of municipal control and utility.

It will afford us much pleasure to send you such number of copies of the enclosed circular as you may desire, and in anticipation of hearing from you at an early date, we beg to be,

Yours very truly,

F. M. GRISWOLD,
Chairman.

STANDARD THREAD FOR FIRE HOSE AND HYDRANT COUPLINGS,

ADOPTED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS, AS RECOMMENDED BY THE NATIONAL FIRE PROTECTION ASSOCIATION.

GENTLEMEN: Realizing the vast and imperative importance to the welfare and prosperity of the country which will result from the speedy adoption and installation of standard hose and hydrant couplings in every community where a fire department with a water supply is in service, this committee takes much pleasure in presenting for your information and consideration the following details of specification together with full size drawings of the established standard for hose and hydrant couplings, as adopted by the leading waterworks and firemen's associations and other national bodies, as nominated on another page.

The ends sought in presenting this matter to you somewhat in detail are two-fold in purpose, first to recall to your minds the halting and inconclusive efforts of past attempts to secure the adoption of a universal threaded coupling and the disastrous results which have supervened in many communities on account of the lack of harmony in such public utilities, and second, to express the hope in having this record before you, supplemented by the special conditions which have prompted us to nominate and advocate the adoption of the particular standard herewith presented, that we may secure your most hearty, earnest and persistent effort to a speedy and final settlement of this very important matter by the adoption of the standard suggested within the territory under your control or influence.

While we fully appreciate the fact that it depends upon the co-operation of the various water-works and fire department organizations to insure the acceptance of any standard involving a change from present practice, we have such an abiding faith in the sound judgment and well grounded public spirit of the members of the various organizations having interest as to feel assured that co-operation in the present attempt is sure to be had after mature consideration of the matter herewith presented.

In the following brief resume of the history of the effort to secure the standardization of hose and hydrant couplings, it appears from the available records that the International Association of Fire Engineers is to be credited with the first organized attempt to secure that result through the action of a special committee, of the then "National" association which in

1873, at Cleveland, Ohio, recommended a universal thread of 7½ to the inch on 2½ inch fire hose coupling, which some departments adopted, and also suggested the use of reducers and expanders as a measure of economy.

1876, suggested that the standard of New York be adopted, no details being recorded, but report was "laid on the table."

1878, there was submitted a proposition to adopt 8 threads to the inch, with an inside diameter of 2½ inch and outside diameter of 3⅛ inch "the use of which was found impracticable" by committee and action by Congress, with penalties, proposed.

1879, a "National Standard" was adopted. being 3 7-32 inch outside diameter, 2½ inch inside diameter with 6 threads to the inch, "V" shaped and slightly flattened at the top. (An unverified record shows this to have been 3 13-64 inch by 2½ inch, with 6 threads flat in shape.)

1883, the convention proposed memoralizing state governments to take action for the adoption of the 1879 thread as a standard.

1890, Mr. C. A. Landy, then representing the Fabric Fire Hose Company, urged the adoption of a standard hose thread coupling, but no particulars of dimensions are recorded.

1891, this same Mr. Landy presented a very complete, intelligent and interesting paper on the subject, in which was advocated the adoption as the standard, a coupling of 3 1-16 inch outside diameter, 2½ inch inside diameter, with 7½ threads to the inch, "V" shaped, which proposition was adopted by the Association on Committee report.

This report of 1891 completes the sporadic action taken by the firemen's association in attempts to seek a common ground upon which to harmonize the existing differences in this most important of public utilities, and the subject remained practically dormant until the fall of 1904, when a committee was selected by the International Association of Fire Engineers to give the matter further consideration in conjunction with a similar committee selected by the National Fire Protection Association, this joint action being stimulated to accomplishment through the disastrous conflagrations which had but recently swept the cities of Baltimore, Rochester and Toronto, where in each instance had been so plainly demonstrated the inability of visiting fire apparatus to render efficient service, owing to the fact that no two cities or towns were equipped with apparatus of like gage as to diameters or number of threads to the inch on hose or hydrant couplings and practically all efforts to help in these times of dire emergency were therefore rendered nugatory. Added to the practical lessons burned into the mind by the conflagrations above noted, was the knowledge that there are dozens, if not hundreds, of other cities liable to be swept by conflagrations of equal severity and under the same conditions of practical isolation from outside assistance, which prompted this committee to enter upon the task set before it with energy and a determination to arouse public opinion, as well as that of the bodies interested in or responsible

for the maintenance of fire apparatus and utilities to the crying evil of present conditions of diversity in the make-up of these essentials to efficient fire fighting.

It affords this Committee therefore much pleasure to record the fact that from the initiative it has been accorded the most cordial and hearty support in its efforts, with the result that the standard as nominated by it has now received unqualified and practically unanimous approval and adoption by the following associations and organizations, by vote at their recent annual convention, as noted:

The American Waterworks Association, West Baden, Ind., May 9, 1905.

International Association of Fire Engineers, Duluth, Aug. 19, 1905.

National Firemen's Association, Kansas City, Mo., Aug. 30, 1905.

New England Waterworks Association, New York, Sept. 14, 1905.

Pennsylvania Waterworks Association, Atlantic City, 1905.

North Carolina Firemen's State Association, August, 1905.

National Board of Fire Underwriters, May 23, 1905.

National Fire Protection Association, May 23, 1905.

To the above might be added the names and titles of various district and state organizations, subsidiary to the above, which have recorded approval of the standard herein nominated, and it will therefore be seen that the matter is now well under way for universal adoption, and it is encouraging to be able to state that one of the most important cities in the country, namely, St. Louis, Mo., has already adopted this standard, changing from six threads to the inch to seven and a half to the inch on all hose couplings and other connections.

While it is not to be assumed that all couplings and attachments for fire service which now differ from the established standard can or will be immediately discarded for that, it is impossible to make the substitution gradual, easy and inexpensive by the use of adapters at all hose and hydrant couplings until the fixed connections on the established standard gage may be made permanent on the plant already installed, while on new hydrants and hose, standard gage should be specified as an essential to acceptance. We are reliably advised that adapters cut to the established standard gage on one side and on the other side to the present gage in use in any department, may be had at a cost of $1.00 each, and can be used for either hydrant or hose couplings.

Another point in the matter of economy of substitution is to be found in the fact that all couplings having seven, seven and a half or eight threads to the inch, with diameters ranging from 3 1-16 inch to 3⅛ inch to the outside of the male thread, may be made serviceably operative with a standard female coupling of seven and one half threads to the inch, by cutting down the excess diameter as the case may require, and this without seriously impairing the strength and efficiency of the coupling. Reliable data, upon which is based the nomination of the established thread, show that the standard 7½ thread female or swivel coupling will accommodate

about 70 per cent of the couplings now in use in this country under the conditions as above indicated.

In the following tables will be found full specifications for the various dimensions and parts of the several standard couplings as now established, which when read in connection with the full sized drawings also attached, should make plain the fullest details needed for their construction, and we trust they may serve that purpose.

NATIONAL FIRE PROTECTION ASSOCIATION STANDARD.

Inside Diameter of Hose in Inches..	2½ inch	3 inch	3½ inch	4½ inch
Number of threads per inch.....	7½	6	6	4

MALE COUPLINGS.

Outside diameter of thread finished.....	3 1-16"	3⅝"	4¼"	5¼"
Diameter at root of thread.	2 8715"	3.3763"	4.0013"	5.3970"
Clearance betwen male and female threads	.03"	03"	.03"	.05"
Total length of threaded male end.....	1 inch	1⅛ inch	1⅛ inch	1⅜ inch

The above to be of the 60 deg. V thread pattern with one hundredth inch cut off the top of the thread and one hundredth inch left in the bottom of the valley in 2½ inch, 3 inch and 3½ inch couplings and two hundredths inch in like manner for the 4½ inch couplings and with one-fourth inch blank end on male part of coupling in each case. Female ends to be cut ⅛ inch shorter for endwise clearance. They should also be bored out .03 inch larger in the 2½ inch, 3 and 3½ inch sizes, and .05 inch larger in the 4½ inch size in order to make up easily and without jamming or sticking.

COMPARATIVE STATEMENT OF DIMENSIONS REFERRED TO IN SPECIFICATIONS FOR "N. F. P. A." STANDARD HOSE COUPLINGS.

Fraction Inches	Decimal Inches	Centimeters	REMARKS
	.01	.0254	To be taken off top and left in the valley of the thread in 2½ inch, and 3 inch and 3½ inch sizes.
	.02	.0508	Same as above for the 4½ inch size
	.03	.0762	Clearance between male and female threads in 2½ inch, 3 inch and 3½ inch sizes.
	.05	.1270	Same as above for 4½ inch size.
⅛	.125	.3175	Cut from female end for endwise clearance.
¼	.250	.6350	Blank end left on male couplings
1	1.000	2.5400	Total length of threaded male end for 2½ inc
1⅛	1.125	2.8575	Same as above for 3 inch and 3½ inch sizes
1⅜	1.375	3.4925	Same as above for 4½ inch size.
2½	2.500	6.3500	Inside diameter of hose coupling.
3	3.000	7.6200	Inside diameter of hose coupling.
3½	3.500	8.8900	Inside diameter of hose coupling.
4½	4.500	11.4300	Inside diameter of hose coupling.
	2.8715	7.2936	Diameter at root of thread, 2½ inch size
	3.3763	8.5758	Diameter at root of thread, 3 inch size.
	4.0013	10.1633	Diameter at root of thread, 3½ inch size
	5.3970	13.7084	Diameter at root of thread, 4½ inch size.
3 1-16	3.0625	7.7788	Outside diameter of finished thread, 2½ inch size.
3⅝	3.6250	9.2075	Outside diameter of finished thread, 3 inch size.
4¼	4.2500	10.7950	Outside diameter of finished thread, 3½ inch size.
5¼	5.7500	14.6050	Outside diameter of finished thread, 4½ inch size.

NOTE—The above table of comparative measurements presents at a glance the various dimensions of the standard coupling and is made to include the metric equivalents in order to demonstrate the adaptability of the standard to that system of measurement.)

This committee will cheerfully furnish any additional information desired upon application to its chairman, or through correspondence with any of its members, and we may add that our most earnest and active co-operation is at the command of all parties interested in the accomplishment of this much needed reform, of we may be favored with their valued suggestions as to the best means and methods of promoting its adoption in any community or throughout the whole country at an early day.

This committe realizes that however encouraging may be the fact that a standard has been established under the sanction and approval of those public bodies which control the use of same, it is not therefore to be considered that the task is finished and may be left to automatically work out the matter of substitution; there must be continued agitation, a campaign of education and appeals to those in authority to take prompt action, and in this effort we feel assured that we shall be honored with your earnest assistance, counsel and advise, and to this end we request acknowledgement of receipt of this circular at your early convenience.

F. M. GRISWOLD, Chairman, No. 56 Cedar street, New York.
G. E. BRUEN, Room 1001, No. 32 Liberty street, New York.
H. C. HENLEY, Century Building, St. Louis, Mo.
C. H. CAMPBELL, No. 431 Equitable Building, Atlanta, Ga.
Special Committee on Standard Hose Couplings and Hydrant Fittings for Public Fire Service.

New York, March, 1906.
Adopted by the National Board of Fire Underwriters, June 28, 1906.

MR. HATTON: Mr. President, I have some correspondence from Mr. Griswold in regard to that matter, and I would say that I know more or less about it, having been on a committee which considered the same matter in the American Waterworks Association, and I would be glad to give some illustrations at some other session of the Convention about it, if it is agreeable.

THE PRESIDENT: We will be glad to hear from you concerning that later.

THE PRESIDENT: Mr. G. A. Parker, Chairman of the Committee on Park Development, promised sometime ago a paper and report from his committee, but they have not yet appeared, but if they appear later, we will have them presented. Our program for

… Standard Hose Coupling.

	INCHES.	CENTIMETRES.
…	2½	6.3500
… 7½		
…	¼	.6350
…	3/16	7.7788
…	2.8715	7.2936
… READS	.03	.0762
…	1.00	2.5400

…IMETRE)

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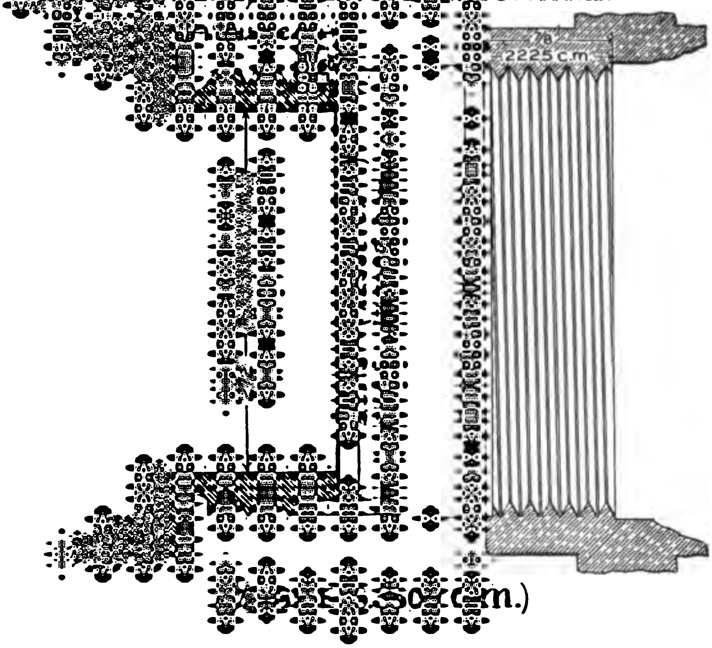
… E CUT $\frac{1}{8}$ INCH

… CLEARANCE.



rd Hose Coupling.

	INCHES.	CENTIMETRES.
	3	7 6200
.6		
	¼	.6350
	3⅝	9.2075
	3.3763	8.5758
	.03	.0762
	1⅛	2.8575

RE)
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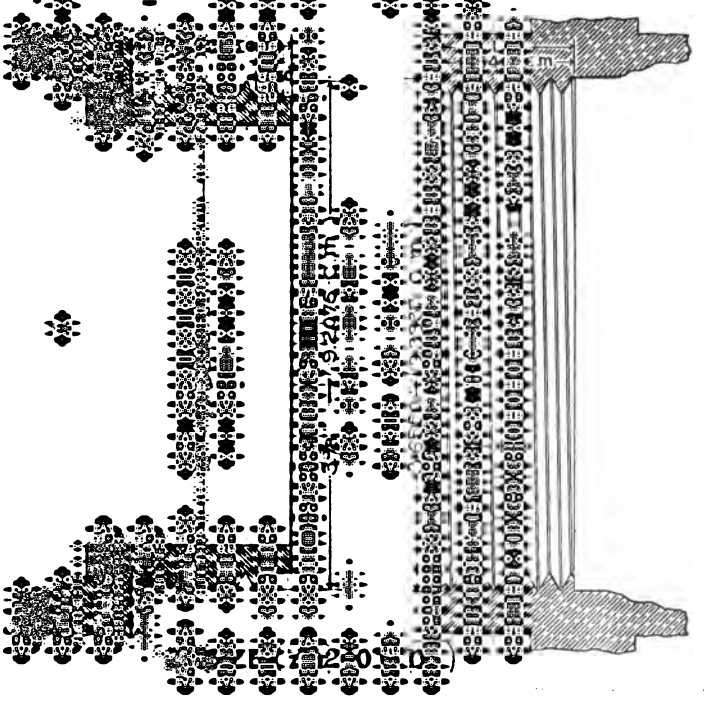

[illegible] Standard Hose Coupling.

	INCHES.	CENTIMETRES.
[illegible]	3½	8.8900
[illegible] 6		
[illegible]	¼	.6350
[illegible]	4¼	10.7950
[illegible]	4.0013	10.1633
[illegible] DS	.03	.0762
[illegible]	1⅛	2.8575

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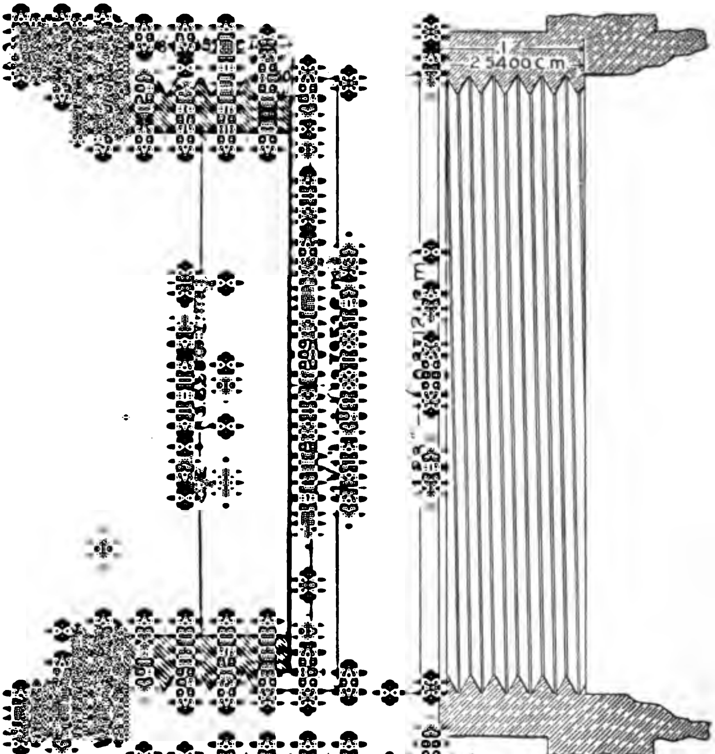
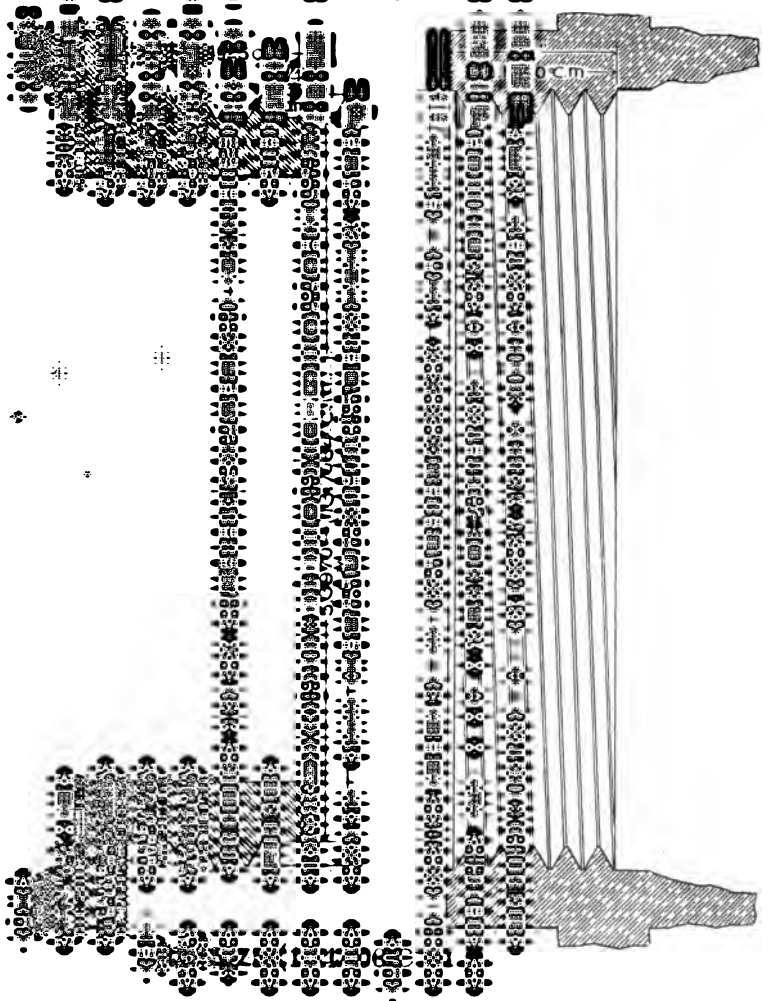


[illegible] n.)

Hose Coupling.

	INCHES	CENTIMETRES.
	4½	11.4300
	4	
	¼	6350
	5¾	14.6050
	5.3970	13.7084
	.05	.1270
	1⅜	3.4925



tomorrow night will have to be limited in order to use a stereopticon, and we will have to put one or two papers over for tonight and bring one forward from Thursday to Wednesday, and I think it would be well to relieve tomorrow night's program of one or two papers. We will now have a paper on "Yellow Fever and Sanitation" read, by Mr. Hazlehurst, of Mobile, Ala.

YELLOW FEVER AND SANITATION.

BY J. N. HAZLEHURST, CONSULTING ENGINEER, MOBILE, ALA.

It is a matter of recent history that on the 21st day of July, 1905, the presence of yellow fever was announced in New Orleans, the metropolis of the South and the second port of export of the American continent.

In rapid succession new foci developed in many other parishes of Louisiana, from whence the disease spread to adjacent states, until on the 17th of November there had been officially reported 8,267 cases of fever with mortality of 900 persons, despite the most rigorous of quarantine restrictions.

It is unnecessary to recount the appeal made by the City of New Orleans for federal aid, nor the wonderful record made by the Public Health and Marine Hospital Service in eradicating the disease after a commencement which threatened to surpass in its virulent intensity the ravages of the fatal year 1878.

Since Major Walter Reed, of the United States Army, had so brilliantly proved the theory of the transmission of yellow fever, there had been no opportunity for a decisive battle against this foe, since the epidemic of 1900 in Havana, Cuba, and that of 1903, at Laredo, Texas, might be dignified only as skirmishes.

How the last great battle of an intermittent warfare waged for more than two hundred years was fought; the details of its maneuvers and tactics, and the final and complete triumph of science in this contest, are incidents of yesterday and scarce need repetition here, but the fruits of this victory may be estimated directly from the record of a more remote past.

Following the epidemic of 1878, Congress appointed a "Board of Experts" to investigate and report upon the facts in connection with that outbreak of yellow fever, which stated in part that during the pestilence at least 18,000 (and probably as many as 20,000) deaths from yellow fever had occurred during the epidemic, representing a loss estimated at $12,600,000, according to the assumed basis of valuation.

It was believed by this board that at least 120,000 cases of sickness from yellow fever took place during the period, and since the loss of time of these patients was a public loss, an allowance for this time of $1,500,000 was made.

To these sums was added the value of the labor diverted from the production of useful activity by attendants upon 120,000 sick persons, or $600,000 more.

Since it was assumed that at least 150,000 persons fled from their homes and passed an average of three months in enforced idleness attributable to this epidemic, this diminution of national wealth was fixed at $6,750,000, the whole loss directly caused by the fever of 1878 being placed by this board at $21,450,000, while there were other losses, not reducible to exact figures, such as depreciation of all values and interest upon same, which probably warranted the board's conclusion that "these losses have been variously estimated by others at sums ranging from one hundred millions to two hundred millions of dollars."

The investigation of the causes and the origin of yellow fever made by this board of eminent experts was barren of results, its findings being summarized somewhat as follows:

That yellow fever is a disease whose specific poison had never been demonstrated, but requiring favorable local conditions for evolution in epidemic form, the nature of such favorable conditions, however, remaining unknown, although yellow fever was observed to be a disease of singular local attachments, becoming epidemic in one section of a city to the exclusion of other portions, and showing remarkable indifference to topographical or social surroundings.

It was also noted that yellow fever, like other epidemic diseases, required a period of incubation between the introduction of the specific cause and the outbreak of the sickness.

Historically, it was shown that this fever in its epidemic form, was a disease of warm climates, its poison being rendered inocuous by freezing temperatures; also that the disease was first known in the West Indies, from whence its importation into Boston, in 1693, and all subsequent manifestations were directly traceable. Further, that in the United States yellow fever was an exotic, appearing first at the national seaports, but never having acquired permanent domicil.

The concluding and literal quotation from this report is worthy of careful attention:

"In its migrations across seas and continents, yellow fever has always followed the lines of human travel and commercial intercourse, and the rapidity, the frequency and the extent of its diffusion in space and time correspond strictly to the rapidity, the frequency and the extent of the communication between infected and uninfected places. No instance is known in which it has passed from one place to another in a shorter time than would have sufficed for a man to have made the same journey."

In view of these negative conclusions and the insiduous and deadly nature of the disease, little wonder that the report of any outbreak created immediate and uncontrolable panic in localities likely to become infected, nor that thousands fled precipitately before the approach of this mysterious and unknown foe.

In the light of subsequent discovery, the wonder is that the active agent of this disease should not sooner have been revealed, and that the real cause of all of this disorder should not long since have been suspected if only from the record left by medical and other qualified observers, a few such being quoted here in evidence. Thus a portion of a report made of a virulent epidemic of yellow fever in Charleston, S. C., and recorded by Assistant Surgeon Harvey E. Brown, is as follows:

"Along some of the principal streets I saw the cellars flooded with water. In the yards I was called into I saw on every side the accumulated refuse of the houses, the kitchen and the stables. * * * The heavy rains of the late summer and early fall had created a state of things well calculated, it seems to me, to generate disease.

"Through many parts of the town, in those (suburban) portions, ponds of water, stagnant and covered with green vegetation, existed. Some of these ponds, I was told, had been drained in former years because they occasioned sickness, and had always been kept carefully dry till this season, when from scarcity of labor they had been allowed to refill by choking up their vents. In many places new ponds were formed by unusual quantity of rain."

One of the most pregnant utterances of those days may be found in a history of the epidemic of 1878 in Chattanooga, Tenn., by Dr. J. H. Van Deman, as read before the American Public Health Association, at Nashville, the following year:

"First, its origin. For a solution of this question let New Orleans answer, for no one doubts that being the focus from whence the whole Mississippi valley became infected, it being carried from there along the course of our great rivers and our numerous railroads to every Southern port and town, almost, until it was traced even to our own mountain home, bringing death and desolation in its fearful track.

"What the cause? We answer candidly we do not know. However, that with us it commenced its ravages in the lowest and most filthy of our wards, raging in great malignancy and virulency in the places before mentioned. The more filth, the more yellow fever. The lower the ground, the poorer the drainage and water supply, there you would find this disease the worst. * * *

"What is the public remedy? I do not mean what medicine shall we give, for too much of this has killed as many as the fever itself; but what shall we do to prevent the disease from coming amongst us in our inland towns and our high elevations?

"We answer: Increase the sewerage of our city; build the sewers long and large; make them of moment; carry their outlets into the streams below our water supply and far out into our rivers; increase our surface drainage; remove our night soil; enlarge our water supply; fill up our wells (for in cities nearly all of them are sowing the seeds of disease)." * * *

As far back as the year 1704, Dr. James Carroll, writing of an epidemic of yellow fever in Baltimore, says:

"The unusual prevalence of mosquitoes during an epidemic of yellow fever has been recorded a number of times."

In Philadelphia, in 1787, Dr. Benjamin Rush noted that "mosquitoes abounded, as usual in sickly seasons."

Commenting upon a most maglinant visitation of yellow fever in Wilmington, Del., in 1802, Dr. John Vaughn observed:

"The season became tropical in the middle of August. The weather from being uncomfortably cool, suddenly became extremely hot, varying from 80 to 90 degrees, with frequent gusts of rain and lightning. * * * Myriads of mosquitoes infested the lower parts of the town from July until frost, having gradually diffused themselves over the borough in September."

Dr. J. C. Nott, of Mobile, Ala., in an article in the New Orleans Medical Review (1847), noted the fact that during seasons when malarial and like fevers were especially prevalent, mosquitoes were abundant, and upon this fact first advanced the hypothesis of the transmission of fevers through this agency, although making certain exception as to yellow fever, since he was unable to account for the observed fact that the mosquito habitually hovered near the ground while his practice had shown infection in the upper stories of houses.

Unable to see the handwriting on the wall, thus science groped its way until a Cuban, Dr. Carlos Finlay, in 1881, tore the bandage from unseeing eyes, and upon his hypothesis, an American commission, first in Havana, and later at Vera Cruz, demonstrated by irresistible proof the fact that a mosquito, of the genus *stegomyia fasciata,* after attacking an individual suffering from yellow fever, was capable of transmitting this disease to the human family. From a survey made by the United States government in 1893 to determine the life zone or geographic limits of the distribution of this particular insect, it became definitely known that this mosquito was self-perpetuating in all of the Southern states bounded by the Atlantic ocean and the Gulf of Mexico, with the exception of those portions of Virginia, North Carolina, South Carolina, Georgia and Alabama, which constitute practically the foothills of the Appalachian chain of mountains.

Within the section indicated, and classified as the "Lower Austral Zone," during the summer months, and particularly during seasons of extreme humidity and heat, the yellow fever mosquito propagates. According to Dr. L. O. Howard, Chief Entomologist of the United States Department of Agriculture, "during the late summer months and in September and even early October yellow fever mosquitoes are brought northward beyond the limits of the lower austral life zone in railway trains, and particularly upon boats going up the Mississippi and Ohio rivers. In this way the mosquito is carried north of its permanent breed-

ing regions, and while the extreme heat lasts it may breed for a generation or two or even more at a point north of its permanent establishment."

The earlier history of yellow fever in North America presents positive evidence of the importation of this disease from the West Indies through the medium of trading vessels clearing from infected ports, although frequently no fever had appeared amongst crew or passengers, for which reason great uncertainty existed as to the active agency introducing the disease; the cargo, the bilge water and even the stone ballast in turn being suspected. Whether under normal or exotic conditions the yellow fever mosquito is found to exist, it only requires the introduction of the infected human for the commencement and continuance of its murderous work, limited or accentuated by local conditions. The mosquito responsible for the spread of yellow fever is a semi-domestic and non-migratory insect, breeding always in stagnant pools, rain barrels or other containers of water, under house drains in cities, but generally in fairly clean water.

The first opportunity in the United States for testing the so-called "mosquito theory," came during the summer of 1903, at Laredo, Texas, from infection traced to Tampico, Mexico.

At that time Laredo contained a population of some 18,000 residing on the Texas side of the Rio Grande river, and about 8,000 persons living on the Mexican section. Neither town possessed either storm or sanitary sewers, and their water supply was furnished by a chartered corporation from the turbid river, and was deficient both in quantity and quality, while the rates were such as to render its general use impossible to the poorer inhabitants and its character such as largely to forbid its consumption by others. Hence the almost universal use of cisterns, casks and other receptacles concerning which Marine Hospital Surgeon officially reported that "as a breeding place for mosquitoes and especially the *stegomyia fasciata,* it would be difficult to improve upon them."

In the same report he also stated that this species was found in enormous numbers and widely distributed.

Shortly after this outbreak, the Marine Hospital authorities assumed control, immediately inaugurating the then experimental work of fumigating buildings, screening cisterns and the oiling of pools, gutters and other likely breeding places of mosquitoes. According to an official report, "so thoroughly was the work of destroying mosquitoes and especially the work of oiling containers and other breeding places performed that an officer of the service detailed in Laredo to study infected yellow fever mosquitoes, could not find, after diligent search, enough *stegomyia* in the adult, larval or pupal stages to carry on his work."

In Laredo, from September, 1903, to March, 1904, there has been upward of a thousand cases of yellow fever with about ten per cent mortality, but for the first time in history the disease had been conquered before a killing frost.

During the late epidemic in New Orleans similar conditions largely existed, only a limited section of the city being provided with sub-

drainage, while all portions of the city were without sanitary sewers. The distributing system of the water works was entirely inadequate and the water supply being unfiltered, carried in suspension ordinarily as much as four tons of sedimentary matter to each million gallons of water, resulting in the almost universal use of cisterns, casks and such containers as may be inferred from Dr. White's report that at the commencement of the epidemic there was in use in the City of New Orleans 68,000 cisterns. Despite the headway gained by the fever there before the commencement of remedial action, and the adverse sanitary conditions, after 3,390 cases of yellow fever, resulting in 459 deaths, the disease was eradicated and all quarantine restrictions removed for more than a month prior to the first heavy frost.

While the triumph of science was again complete, the costs of victory were heavy, several hundred thousand dollars having been expended during the campaign, while indirect losses could hardly be estimated.

From the record of the past two facts have been absolutely demonstrated:

First, that complete isolation and non-intercourse from and with the outside world to be secured through unceasing vigilance can prevent a first infection of any community without the tropics. Second, that after infection and even under the most unfavorable circumstances and conditions energetic remedial measures directed upon scientific principles as now understood will control and effectually stamp out any epidemic of yellow fever.

While these facts are comforting assurances and mark a distinct advance, it is prevention rather than cure which should occupy the attention of those in authority, otherwise our cities, towns and villages, situate within the life-zone of this deadly peril, are forever doomed by fear of this introductory spark and through the instinct of self-preservation to maintain a costly and barbarous "shot-gun" patrol with the ever present possibility of accidental infection with all of its attendant hardships and misfortunes to stricken communities.

Students of this subject can hardly fail to become impressed with certain facts in connection with the recurrence of yellow fever in the United States since its first entry; first, that while yellow fever formerly raged in many of our Northern seaport towns, it has made no visitation north of the Mason and Dixon line for so many years that apprehension as to such epidemic in those sections of the country no longer exists. Second, that while formerly an epidemic in the South continued its spread into nearly every city until its course was checked by frost, since 1878 fewer cities were invaded and that certain cities, often far removed from each other, seemed to suffer under a peculiar fatality in respect to its attack.

Science must discover some reason for these facts. An explanation given by Dr. J. H. White, of the Marine Hospital Service, as to the

disappearance of yellow fever from Northern cities is certainly entitled to respectful consideration, and is as follows:

"It would be a false claim, if set up by any of our great Northern cities, that they intelligently provided themselves with municipal utilities which appealed strongly to their ideas of creature comfort and general cleanliness, and which incidentally and entirely accidentally eliminated the mosquito at the same time. These public utilities were a thoroughly controlled water supply, sewerage, drainage and pavements, and these four, not one, but all of them, were essential to the end attained."

Dr. White's contention is that although accomplished accidentally, the agencies directly responsible for the elimination of yellow fever, were the introduction of these public utilities which prevented the propagation of the mosquito.

Let us consider the evidence in support of the fact that these same agencies may be relied upon to prevent the recurrence of yellow fever within the section now known to be the habitat of the insect responsible for the spread of this disease. Parenthetically it may be remarked that seldom does the construction of water works, sewers and street pavement occur simultaneously, but generally in the following order:

First, water works are built; secondly, sewers are demanded to remove the waste water of the water supply, and lastly, after water and sewer pipes are laid, the streets are paved, the surface drainage being an incident of this latter construction.

After the epidemic in Memphis during the year 1878, when, according to Keating, some 17,600 cases of yellow fever occurred, resulting in 5,150 deaths, and the return of this disease the year following, Col. George E. Waring, C. E., was retained to design and construct a system of sanitary sewers, the first comprehensive application of the separate system upon this continent.

Concerning the potentiality of these sewers in the prevention of another disaster from like cause, Colonel Waring made the following remarkable prophecy in his address before the American Public Health Association at Nashville, Tenn., November, 1879:

"I trust that, as I am neither a Southerner nor a physician, I may be excused for attaching more importance than many of you probably do to the proper drainage and cleaning of a city, and to the proper disposal of its outflow, and more than to any system of quarantine. My knowledge of the history of the yellow fever epidemics in this valley is infinitely less than yours, but I feel warranted, and I take my warrant from the history of the plagues which devastated the filthy mediæval cities of Europe, and from my own knowledge of the want of cleanliness and want of drainage in the City of Memphis, in venturing the suggestion that even that fever-smitten town may be made an impossible field for the invasion of yellow fever in epidemic form."

While Colonel Waring's theories probably had few converts, the necessity of doing something toward securing relief from this scourge

drove the people of Memphis to commence its sewer system which now comprises 210 miles of sanitary and four miles of storm sewers.

Since the first work was inaugurated, Memphis, although frequently menaced, escaped any attack of yellow fever until the year 1897, when the plague being general throughout the Mississippi valley, fifty cases and fifteen deaths were accredited to Memphis.

From a population of 33,592, according to the census of 1880, that city had grown to 102,320 inhabitants in 1900.

From a recent letter from the City Engineer of Memphis regarding the situation there in 1897, the following is quoted:

"Regarding fever conditions here in '97, beg to say I have investigated the matter and find that we had fifty cases and fifteen deaths. All of these cases were distinctly traceable to one locality except one, which was shown to be imported from New Orleans. The infected district was unsewered. It was inhabitated principally by people of the lower class. It was partly paved and had water connections."

Before the year 1880, no city in the South had more than a most fragmentary system of sewers, but after the example set by Memphis, the larger towns, one by one, inaugurated more or less extensive and comprehensive systems of sewers, until of the principal cities there remains unsewered only New Orleans, Vicksburg, Pensacola and Galveston.

Systematic effort has been made by the writer to secure statictical information as to paving, sewerage, water supply and like municipal improvements of all the cities located within the fever zone, and as well, the dates since 1878 showing recurrence of yellow fever in each.

Reports from more than twenty such cities show that, exclusive of Memphis, whose experience has been recited at length, only four towns have been afflicted with yellow fever since the construction of systems of sanitary sewers. These towns are Montgomery, Ala., Natchez, Miss., Baton Rouge and Alexandria, La.

The most important of these towns is Montgomery, whose sewers were constructed in 1889, and despite which, suffered from fever in 1897, 134 cases being reported during that year. At the time these sewers were constructed the city had a population of only about 20,000, and this had expanded to more than 30,000 at the time when the epidemic occurred. It is also reported that the fever at that time existed only in sections of the city which were unsewered and that no case was recorded within the sewered districts, indicative of the fact that the city had outgrown its first sewerage works.

Natchez, Miss., during the past year suffered by yellow fever to the extent of 143 cases and seven deaths. This city has forty-five miles of unpaved streets, seven miles of sanitary sewers and two miles of storm sewers. According to official report, only two cases of yellow fever occurred in dwellings provided with sewer connections. It is also reported that connection to sewers is not compulsory, and few such have been made. The sewers were constructed and owned by a franchise corpora-

tion supplying the city with water. Numerous cisterns are in use owing to a deficient water distribution and supply.

Baton Rouge, which also reported ten cases of fever and one death during the past epidemic of fever, has also a deficient water system, owned by a private corporation, and relies also largely upon cisterns and like water containers. In 1901 seven miles of sanitary sewers were constructed by the city, but only 150 connections have been made voluntarily.

Lastly, the town of Alexandria, La., built its nine miles of sanitary sewers during the year 1900, and in this town connections are compulsory. During 1905 nineteen cases of fever were returned, with one death. Concerning conditions there during the fever continuance, the city engineer writes as follows:

"While the city water is generally used, a considerable number of the population have tanks, cisterns and barrels for gathering rain water. * * * The spread of the fever in this place seems to have been due entirely to the quite extensive use of cisterns which were not screened, and so formed breeding places for the mosquito."

Alexandria is built upon ground extremely low and flat, and open canals and ditches are relied upon to remove the storm waters. It is especially worthy of note that during the epidemic of 1905 New Orleans, Vicksburg and Pensacola were the principal sufferers; cities deficient in sewers of all descriptions and in contrast, during the same year refugee or imported cases of fever occurred in Montgomery, Ala., Tampa, Fla., and Shrieveport, La., cities which in the past, from such infection would undoubtedly have been quick to respond, but no spread of the dread disease occurred. It is significant that these three cities have been effectually sewered and connections are made compulsory.

If such statistical facts are considered merely coincidences, in further support of the theory that sanitary sewers, especially when augmented with an abundant and suitable water supply may be relied upon to prevent the spread of yellow fever, the cases of Vera Cruz, Merida, Yucatan, and the City of Havana may be cited. The first of these cities was sewered and paved about three years since, and although for generations, each year witnessed an outbreak of yellow fever, whose virulence was limited only by the extent of the immune population few cases and no epidemic of yellow fever has since been reported.

The City of Merida, following the example of Vera Cruz, has lately expended something more than four millions of dollars upon her public utilities. This city of the tropics, accustomed each year to reckon the victims of yellow fever by the hundreds, reports only ten cases of fever for the fiscal period, accounted for by a recent press dispatch, as follows:

"This great improvement is due to the improved system of isolation and the institution of modern sanitation."

But that isolation alone may be expected to fail in providing adequate protection may be well suspected from the late experience in Havana, a city where this method of protection may be admitted to have reached its

highest development. Infected from the epidemic of 1905 at New Orleans, and despite the most active efforts of its health officers, yellow fever made marked progress there, and resulted in the establishment of quarantine restrictions against that city upon the part of North and South American seaports. Havana has no system of sewers.

In view of the evidence submitted, the deduction seems warranted by the facts that even a city in the tropics may be freed entirely of yellow fever by providing modern municipal utilities, and the potentiality of these agents must be far greater when applied to communities where yellow fever is known to be exotic; hence the writer feels fully justified in the assertion made by him at the close of the campaign inaugurated by the Mobile Auxiliary Sanitary Association, as follows:

"What has been written is not intended to belittle or detract from the intelligent effort of our local health board in its successful maintenance of scientifically formulated quarantine regulations, nor to underestimate the work accomplished by this Association, but that the fever has not fastened upon our city, seriously menaced though it were, is probably neither a miracle, due to a special dispensation of Providence, nor to the preventative and remedial measures exercised during the present crisis. While each has done what he could, with the previous installation of a bountiful water supply and the construction of a comprehensive system of sewers, followed by the completion of a considerable area of street paving, exercising reasonable prudence and precaution, no longer need Mobile tremble at the outbreak of fever in this section, for danger from this source has passed for all time."

THE PRESIDENT: The paper is now open for discussion, gentlemen.

MR. WEISSLEDER: I have listened with much interest to the reading of this paper, and it is a serious one, and I would not revert to this but for the fact that Cincinnati raised thousands of dollars to help Dr. Clark Davis welcome the refugees from the South, and who treated hundreds of cases of yellow fever in its incipient stages in Cincinnati; while there was a clamor against it, the citizens through the council voted large sums of money as an emergency fund to help these refugees, and I think it was a proper action on the part of the citizens of Cincinnati, and it was only humane. I move that this paper be placed upon the records of this convention, and that we extend a vote of thanks to the gentleman for it.

SECRETARY: I might say that I was associated with Col. Waring in the Memphis sewerage, and had an opportunity to learn

something about the general situation and the condition of the city, and their methods of taking care of the sewage. There were only four or five sewers in the city previous to 1880, which connected the principal hotels and which run by tunnels direct to the river. The custom was to dig cesspools in the yards just where they happen to want them, use them until they are filled up, then instead of cleaning them out, simply cover them up. I remember distinctly one place where we had to run a long connection of 120 feet through yards where we passed through four of these cesspools that had been filled up without any attempt to clean them out. You can imagine the conditions we found when we went through them. This matter, whatever you may call it, was partially decomposed, and it has always seemed strange to me that the epidemic did not break out before and that it did not carry off more people that it did at that time.

MR. HATTON: Mr. President, it must have been a very serious thing for the people in the South that was visited with yellow fever, to try to find out the ways and means of preventing it, before they discovered that the mosquito was alone responsible for the fever. And when they did find the mosquito was responsible for it, it seems to have explained all the acts that had formerly been ascribed to something else. For instance, during the last epidemic in Pensacola, and I have become quite familar with that one, the yellow fever was entirely or almost entirely confined to the lower districts of Pensacola. Pensacola lies low in the business districts and half a mile back from the bay it rises to a point 65 or 75 feet with a pure sand foundation, and no water lying upon the surface, whereas in the lower part of the city there are two or three streams backing in from the bay and the water lies in those low places. Nearly all of the yellow fever cases were in those low sections and none whatever except an isolated case up in the upper portion of the city, showing conclusively that it is the drainage more particularly than the water supply that causes the trouble. We put forth too much thought on the question of a pure water supply and not enough to drainage. It showed conclusively that what the City of Pensacola needed was drainage, in as much as it had one of the

best water supply systems, so far as the purity of water is concerned, of any city in the United States. As soon as they awakened to the idea that it was the stagnant pools of water lying around in the lower sections that spread the yellow fever, they drained those out and spread them over with antiseptics, and the yellow fever began disappearing, and this paper of Mr. Hazlehurst's describes the situation in the South better than any other paper on the subject that I have ever heard read. I think the Society owes him a debt of thanks for preparing it with the great labor that he has done.

THE PRESIDENT: The thing that impressed me more in the paper was the fact that the last epidemic in Memphis they had fifty cases and fifteen deaths; they all occurred in a limited section of the city which had not yet been sewered, and no case except an unimportant case or two appeared in any other part of the city.

Also, the emphasis the paper puts upon paving as being a part of the improvement which is really necessary in order to reduce the danger of yellow fever. That is really only a branch of the subject, because all good paving simply means that you have reduced the amount of water which stands on the surface in public land of the city, and the necessary consequence in putting in the pavements is, it carries the water off. Is there any other discussion, gentlemen?

MR. WEISSLEDER: There is one remark I would like to make, and that is this: the paper referred to the matter of low temperature disposing of the fever and preventing it. In 1882 Professor John Gambee, of London, England, devised a method of disinfecting the holds of ships. He was employed by some department of the government to erect a plant at Galveston, Texas. He used sulphuric acid, common clay treated with hydro chloric acid, which produced chloride of alumina, and made a solution of same, and that was brought down to a low temperature, nearly freezing. He pumped that through the holds of the ship, and the bilge water displaced by putting the chloride of alumina in the water he disinfected by low temperature, as well as the chemicals used, and I think possibly some of us remember that work in 1882.

THE PRESIDENT: If there is nothing further in the way of discussion, those in favor of the motion to spread the paper upon the minutes of the convention, will make it known by the usual sign, those opposed, no. The motion is carried and it is so ordered.

THE PRESIDENT: We have one more paper for tomorrow night we would like to bring forward at this session, and that is the paper by Mr. W. H. Luster, Jr., on the "Improvements of Elizabeth River by Eliminating Sewerage Pollution."

THE CONTEMPLATED RIVER IMPROVEMENT AT ELIZABETH, N. J.

BY W. H. LUSTER, CITY SURVEYOR.

The sanitary and aesthetic conditions governing streams, which have been made receptacles for the sewage of towns, have, of late years become subjects of great prominence, by reason of the increase in population, and consequent greater pollution of the streams, and also what may be called an advance in all classes of people to a higher sanitary and aesthetic civilization.

Forty years ago a small stream or water course that had the proper grade to convey sewage to another locality, was regarded as the proper economical place for such disposal, and the nuisance which was to come, never entered into consideration of the problem.

The City of Elizabeth, N. J., a city now having a population of 65,000, is reaping the whirlwind of such construction.

About forty years ago it was decided that a sewer system was necessary, and the city surveyor submitted plans for the system, delivering the sewage to the water front of Staten Island Sound, where it would have been easily absorbed by the sea water; the great cost of this plan defeated it, and as a substitute, he prepared plans which drained nearly the entire sewage of the city into the Elizabeth River, a small stream, tributary to Staten Island Sound, and tidal and navigable for about two miles from its mouth.

At the time of building the system the upper portion of the stream was utilized as a mill pond, and the largest sewer in the city, emptied its contents just below the dam.

The drainage area above this dam was about 21 square miles, and in the dry weather period very little water flowed to the pond. The day's work at the mill nearly exhausting the supply and the night filling it again. This flow of the water during the day sent the sewage down the stream, so that until the dam was carried away by freshet, nothing very obnoxious was noted, but since then, the increase in population, the use of some of the water above the sewer for public supply, and clearing the

land of trees, has caused a greater volume of sewage to flow into a diminishing volume of water; at one period Mr. Francis Collingwood, (M. Am. Soc. C. E.) measured the volume of stream and sewage flow and found the dilution was only one in six.

Elizabeth has the combined system of sewers, and sizes were computed by the formula

$$\log D = \frac{3 \log A + \log N + 6.8}{10}$$

and until about twenty years ago no great complaint was heard as to the efficiency of the sewers in time of storm, or contamination of the river by deposit of the solids of sewage, but as pavements were laid, houses built, and the population increased, the sewers became gorged during storms, and the river became vile, and during the past few years these conditions have increased to an alarming extent.

In some localities storm water sewers have been constructed which have relieved some of the congested districts, and now a demand for the purification of the river has reached such proportions that the city will have to eliminate sewage from it, in order that the stream may be sightly and inoffensive to the nose.

Notwithstanding popular clamor, the writer does not believe that the present condition of the river is or has been the direct cause of any illness in our city, but in his opinion the improvement will be made simply from an aesthetic point of view.

The writer has had this subject under consideration for several years, but never until the past year has he had the opportunity or means placed at his disposal for a systematic study of the conditions; but during the year 1905, the public demand for improvement became so great that he was directed by the city council to study the situation, and prepare plans and furnish estimates of cost for such improvement.

The writer found seven trunk sewers, ranging from 2 feet by 3 feet to seven feet circular opening, and twelve pipe sewers, from 10 inches to 18 inches, draining into the river at elevations from 0.00 to 5 feet above mean low tide, all being within a distance of about 1½ miles. The tidal flow at certain stages of the tide carried the sewage from the lower sewers up stream, depositing the solids along the bed and sides, and the retrograde movement deposited the remainder, and those above the tide, by reason of the small velocity and inequalities in the river bed deposited their share of filth.

The velocity at no time, except during freshet, is over two feet per second, and the average velocity is not over one foot per second, the dilution, as stated before, is at times, only one in six, in the upper part of the river; while where it is subject to tidal action, the dilution is much greater, so in the dry weather period it is exceedingly offensive to eye and nose.

Adjacent property owners have made the situation worse by throwing all kinds of waste material in the stream, including tin cans, stove pipe, decayed vegetables, old bedding, baby carriages. bottles and dead domestic animals. This practice, with the sedimentation of sewage, and the deposit of mud from freshet and storm, have filled the river from one to two feet, making the invert of the most important sewer about one foot below the present rived bed.

To relieve this intolerable condition and render the stream sightly and inoffensive was the problem; that it can be accomplished is shown by the condition of the water above the sewers, which part of the river is not tidal, where it is clear and shows no signs of pollution, and fish live in it, but below the sewers, all the higher organisms are absent.

Mr. Francis Collingwood, M. Am. Soc. C. E., some years ago, reported a plan to clean the river, and the writer, in his investigations came to the same general conclusions, as the result of his work, and with but several minor changes in route and the elimination of tide gates, the plans are identical.

The problem resolved itself simply into the question, How shall we divert all the sewage entering the river, without disturbing the present sewers to any great extent, taking into consideration the fact that nineteen sewer outlets, at elevations of from 0.00 to 5 feet above mean low water, all enter the river at a distance of over a mile from the water of Staten Island Sound?

Manifestly, it is impossible to take all the sewers to the sound by gravity, without radical changes in the old system, and as the demand is for the total elimination, the question resolved itself into two phases: First, either a complete change in the sewer system of the city, reconstructing it at a cost of over a million dollars, and placing the outlets at points on the sound shore, to where it would flow by gravity, or, second, to leave the present sewers and build an intercepting sewer under them, and then raise the sewage by pumping to a height sufficient to let it flow by gravity to the sound.

Investigation showed that the old sewers were in a good state of repair and now fairly efficient in carrying off storm water and sewage. Their condition may be gauged by the fact that it costs only $4,000 per year to clean and keep about sixty miles in repair.

A gravity system of intercepting sewers without change in the existing sewers would not completely eliminate the sewage from the river, and the sewer would be so flat that it would be filled with tide water for about two miles, causing deposits which would be a cause of expense, and at high tide they would not be effective in certain localities.

The above facts led the writer to abandon any new system involving radical changes in the present trunk sewers and the only way left was to tap the existing sewers, divert the sewage and pump it to a higher level, and dispose of it in the Staten Island Sound at some point where

the odor will not be obnoxious, and where the tide will carry it away and absorb it quickly, and the following was the plan recommended:

Build an intercpting sewer on both sides of the river, of sufficient size to take not only the sewage, but the first flush from storm, joining them together below one of the present large sewers, and continuing to a pumping plant, lifting the sewage about eighteen feet, and from there let it flow by gravity to Staten Island Sound to a point which is probably one of the best sewer outlets in the State of New Jersey.

The sizes of the sewers were computed by Kutter's formula, and the quantities were computed from an estimated prospective population.

All the sewers entering the river are from a strictly residential portion of the city, and no factory waste enters it. The building plots are large; but in estimating the quantity the fact that the land might be subdivided later was taken into account, and 12½ lots per acre was used, with 5 persons per lot, with an allowance of 50 gallons of water per capita per day. At present the lots average about six to the acre.

In locating the position of the pumping plant the writer took into consideration that at some future date it might be advisable to purify the sewage before final disposal into tide water, and the system adopted and the location adapts itself to a plan of that kind without any change in the trunk sewer or pumping plant, it being located about an eighth of a mile from a tract of ground that is so situated as to be ideal for that purpose.

Many writers on the disposal of sewage into sea water claim that there is no necessity for purification unless the fisheries are of such value as to warrant the expenditure. The fisheries in our immediate vicinity are and were immaterial, but small as they were they have been practically destroyed by sewage and factory waste, and the water presents at times that greasy turbid appearance so noticeable at sewer outlets. This condition is on the increase, and finally as municipality after municipality make the waters of Staten Island Sound and New York Bay the place of sewage disposal it will increase the pollution until either the State or Federal Government will demand that such pollution cease. If the disposal into sea water was permitted by only riparian municipalities the danger would be far in the future, but riparian municipalities have constructed trunk sewers through private lands and through streets of other municipalities until our inland tidal waters now show the effect, and the proposed sewer from Patterson to tide water is another project that will add its mite to the ever-increasing pollution.

That the sea water in our vicinity is polluted I will state as an evidence that the teredo has ceased to be a cause of alarm to dock builders along the Hudson River and Staten Island Sound.

In view of these facts the writer deemed it advisable to recommend an intercepting sewer system, including pumping plant which would adapt itself to purification later, and not consider what in this case would be the more expensive system of gravity disposal to sea water.

In the plans adopted, the danger of a stoppage of the pumps would be slight, for in such a case the sewage would flow into the river by the old outlets, but for such short periods of time that no serious damage would be the result, as the water is not used for drinking or commercial purposes.

After eliminating the sewage the banks and bed of the stream are to be thoroughly cleaned from the head of navigation to a point about 1,000 feet above the upper sewer and the bed brought to a regular grade.

This cleaning and grading will give some relief from freshets, from which we suffer occasionally, and give a greater velocity to the water, so in case a stoppage of the pump occurs, the velocity will soon carry away the objectionable matter which will then flow into the stream.

The entire cost of the plan is about $200,000, and any one familar with the stream will say that it will be money well spent.

THE PRESIDENT: The paper is now open for discussion, gentlemen.

MR. SHERRERD: Mr. President, one phase of the question of the construction of such a sewerage system as has been described in this paper, that is, the construction of intercepting sewers, to take the flow out to salt water, where that is available, in connection with trunk sewers, might be of interest; it is a problem in connection with the distribution of cost, which is causing a good deal of consideration in connection with the project. The fact that many manufacturers, manufacturing plants, dye concerns and factories which have a very large amount of waste, located along the rivers, discharge directly into the rivers, so that when you construct an outlet for the sewage, you must, in order to purify the river, take care of those factory wastes in some manner. This question is very important because the waste alone amounts to more than the entire sewage of a city of 100,000 population, and I imagine that the same problem presents itself in other cities, that is, whether it is fair for the city at large to pay the added burden of the maintenance—especially where pumping has to be resorted to for the discharge of the sewage. It is due to the large factory waste, and perhaps it is in connection with the distribution of cost—some such basis as this to be used; that the rate of the capacity on which the sewers are constructed, be used as the basis, say, if is on the rating of 150 gallons per capita, or 200 gal-

lons per capita, that the mills which are getting the use of it be asked to pay an additional sum, for their wastes are more than that rate per capita,—the number of hands employed in the factory. This would act in two ways, one in reducing the burden to the municipalities, who have to maintain sewers, and the other to make it the object of the mills to treat their waste, and so reduce the amount of the discharge. A number of the mills have found it economical to do that, and perhaps other mills will also find it so.

MR. HATTON: Mr. President, the disposal scheme this paper suggests is the same old scheme after all of discharging the liquid wastes into Staten Island Sound. Now, any one crossing the river from either Hoboken or Jersey City, or going across to Brooklyn, is struck with the foul looking water over which they sail. The people in that section have undoubtedly all seen it so many times that their point of view is entirely closed; and from time to time these municipalities surrounding New York City have discharged their sewage and manufacturing liquid wastes into the streams and they all get down finally around New York City and that vicinity. The time is coming, and I do not think it is far off, when those five or six millions of people that now contribute to the pollution of that water, must find some means, as the City of London did, to get rid of that pollution. The National Board of Health of the United States has considered that question carefully in three of their meetings, and the condition of the water around New York harbor has been before them and discussed by the members of the board, and there was a resolution passed by that board of health suggesting to congress an act by which the pollution of the streams under government control should be stopped. While that paper is a very excellent paper, it seems to me that the writer has not touched upon that point as strong as he might have touched on it, because in his paper he realizes that by carrying out his system of intercepting sewers, he is still adding to the pollution of that water. Nearly every society of this character has at one time or another passed a resolution or suggestion that municipalities throughout this country should condemn the custom of discharging crude liquid household and manufac-

turing waste into their abutting streams, and it seems to me that this organization might lend its voice for the same purpose. We are in the South at this meeting,— and I trust I am not getting off the point—where very little has been done or agitated in that way; they are still discharging or largely discharging their crude wastes into the nearest water course, and the time is coming when they will find out their mistake, and I think it would be well for this Society to consider that matter before adjournment.

MR. WEISSLEDER: The last gentleman's remarks came home to the facts as existed in Cincinnati years ago; the water supply was being improperly polluted, and the question arose what would be done. The building of a new water works was undertaken and is nearly finished, and it will give us a better water supply away from sewage contaminations, and no doubt every community is interested in that question.

MR. SHERRERD: I would like to say this, that this question of the polluted condition of the New York harbor has been pretty well and thoroughly investigated by a Commission of Five, I think, appointed by the Governor of New York, and, I think, the speaker preceding me in referring to that matter has probably gotten one side of the story only in connection with the filthy condition of the harbor, because certainly the New York State Commission, while admitting that their own citizens, at least three millions of whom discharge directly in the harbor, agree that as yet that has not affected the harbor, but to put the sewage of half a million more in there from Jersey would be a very considerable detriment, although the Jersey sewage is out three miles in the harbor. The report, or conclusion of the report seems to be that the present rate at which the contamination of the harbor is proceeding, something must be done, and it seems to us that those who happen to be in the other city and reside in Jersey, that we might join with them in discharging into the bay for a few years at least, because our sewage goes there anyway, as theirs does. The question is one that I think has perhaps been taken up by the National Board of Health on the suggestion of the New York people, but I do not

think any ruling has ever been made on the subject. The remedy I think will be eventually that the sewage of the entire Metropolitan district must be collected and perhaps first for a while discharged in the upper harbor, and then afterwards subjected to some sort of treatment, and that's the method that the half million people in Jersey hope to introduce in connection with the trunk sewage. Around Boston, where they discharge their crude sewage into the harbor, there is some objection to the discharges. I think the principal one has been at Moon Island, where the sewage is held in reservoirs and discharged in large quantities at certain dates, the object being in that method of discharge to discharge it on the ebb flow to get it out in the sea.

THE SECRETARY: I am very glad to hear from the gentleman who has just spoken that the conditions as partially set forth by Mr. Hatton are not entirely so. I fully agree with him, and I think everybody will who has ever been across New York harbor, that the waters are in very filthy condition, but the gentleman has just stated that the people of New York were so alive to the situation that they were unwilling for the sewage of 120,000 Jerseyites to be added to it. While the New York people may have objection to the Jersey sewage and Jersey mosquitos, they certainly have no objection to the Jersey people. But seriously speaking, the question of the pollution of New York harbor has been taken up seriously, as stated by the last speaker. A state board was appointed to consider and make report on the matter. The life of this board expired by limitation last winter, and it made a report to the legislature, and a bill was passed by the legislature making or creating a new commission, and the commission has been appointed by the Mayor of New York, and is to take up the matter in a systematic and thorough way with a view to eventually entirely doing away with the pollution of the waters in New York harbor. It certainly must be done in a comparatively short time, when we consider that there are over four millions of people in the city and that it is rapidly growing and the water is being used and churned up and stirred continually.

MR. HATTON: Mr. President, I believe as a matter of fact the necessity of doing something for the harbor towards purifying the water is more from an ethical sense of view than from the point of health, is it not?

THE SECRETARY: I don't think so.

MR. HATTON: That is, there is no water used for domestic purposes taken from the harbor?

THE SECRETARY: Not at all.

MR. HATTON: Then that comes back to the proposition stated in the paper that the purification of the stream was purely from an ethical point of view, and it is right and proper that we should look at it very largely from that point of view, aside from any point of view of health. We want to purify the water and streams; they are given to us in a pure state, and we should keep them in a pure state.

MR. PARKES: As a farmer from a farming country, I want to rise to say that all this talk about New York harbor does not interest us. If some of the brothers would come as far as Baltimore tomorrow, we would be glad to hear about it; don't stand around in New York all day.

THE PRESIDENT: I do not know whether this is an entirely ethical question or not. I have a branch of it under consideration which is likely to be more than that, if they are able to do what they seem to be willing to try to do. Some one is preparing the definition of what is pollution of a stream, and is trying to get it in shape so that it can be adopted by the legslature and put in shape to prevent men from throwing apple cores in streams for that matter without danger of arrest. It seems to me that if it comes to that point it will be a very practical question. Of course they are going at it from an ethical standpoint. I have that definition now under consideration, and I am trying very hard to find some way to present the subject, so that it will have some reasonable idea in it. It seems to me that we must look at this thing from a good many different points of view, the taking care of the puri-

fication of wastes, and there are several different things to do. I have for example this thing which will illustrate what I mean. A small system of sewers which has been completed,—a very large tannery has been allowed to discharge in it,—in fact their former discharge has been taken up, and their present connection with the sewage is all they have, and they discharge their refuse in the sewer without any purification whatever. It has very nearly stopped the sewer up twice, besides producing a very objectionable odor at its mouth. Now we have simply said to them, or to that tannery, you cannot discharge into this sewer any longer unless you will purify your discharge sufficiently so that it will not cause the deposits in the sewer that we have at the present time. We have a sewerage plant for a settling basin, and when that is completed we will have done away with the damage to the sewer itself in the way of stopping it up, and doing away with a large part of the damage of the streams by the deposits out of the outlet of the sewer. In this particular case, the settling of the waste before it is discharged in the sewer, will remove all practical difficulties. Now what I am doing or tryinig to do with reference to this definition of pollution, which we are trying to enact in a law is, to change it so that there will be some sort of elasticity to the definition so as to view circumstances practically as well as ethically.

Is there any further discussion of this paper; if not, I want to call your attention especially to the exhibits at this time; I think they are practically ready for you to see them, and we have left an hour or so before dinner time for you to go into that room. We will have a good program this evening of five or six papers, one or two of them I think we will have to discuss, and will be glad to have you come promptly at 8:00 so that we can get through without trespassing on our time.

I believe the Secretary has some announcement to make.

THE SECRETARY: I desire to offer this resolution:

Resolved, That Section 1, Article VII of the Constitution be amended by striking out the word "Wednesday" in the first sentence, and inserting the word "Tuesday," so that the Section will read:

"Section 1. The annual meeting of the Society shall be held on the second Tuesday in October of each year, in such city as the majority of the members voting shall decide. Selection of place of meeting to be made after the officers shall have been elected; provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2."

THE SECRETARY: I desire to also read this communication from the Birmingham Athletic Club:

BIRMINGHAM, ALA., Oct. 9, 1906.

The Board of Governors most cordially extend the privileges of the Birmingham Athletic Club to the members of the American Society of Municipal Improvements and trust you will take advantage of the many attractions to be found in our building.

Reading and writing rooms, lounging rooms, pool and billiard parlors, bowling alley, chess room, a complete gymnasium, a complete bath room, including a large swimming pool, will be placed at your disposal.

We will be glad to have you with us and those desiring to take advantage of this invitation may obtain visitor's card by calling at the Club Building, Twentieth street, between Fifth and Sixth Avenues.

Very truly,

C. H. MILES,
Secretary.

THE SECRETARY: Through the courtesy of the Birmingham Street Railway Company, all badges of the Society will be accepted on street cars good for a fare, so that no fares will be required of anyone wearing the badges.

MR. HATTON: I move the thanks of the Society be extended to the Athletic Club and to the Birmingham Street Railway Company for their courtesy in these matters.

THE PRESIDENT: I will take the liberty of referring these matters to the Committee on Resolutions, which usually takes care of those matters at the close of the meeting.

THE PRESIDENT: I want to make a couple more of announcements, and that is with reference to the trips tomorrow. On Thursday morning promptly at 9:30, Mr. Bowron will give an explanatory address on the Birmingham District. He will tell us

about the trip we will take tomorrow, and also the one on Thursday, and will explain the different classes of industries which we have here. The carriages will start from the city hall at 10, and you want to be sure to be here before 10:00, and my advice to you would be to be here at 9:30 in order to hear Mr. Bowron's address. On Thursday morning our trip will be by train, and it will leave on schedule time. We want to start from the Union Station, where we all came in, and we will start promptly at 10:00, so that any of you that are not there at 10:00 will get left; now besides that, the trip will be on schedule time, so that all of you will want to keep one eye on the leader, so that you will not get left in some far off part of the trip, and have to find your own way home. Those are important things, because we will tie up the Mineral Railway with travel all the time we are on the trip, and it wll be necessary for us to travel on time—on the time they have fixed for us, and so please remember that is the schedule time for the trip, and we will have to follow strictly the schedule. The ladies, of course, are welcome on both these trips. Tomorrow we will favored with an old time Southern barbecue by the Waterworks Company at their plant on the mountain, and that will be our entertainment for the day. On Thursday we will be served with a light lunch on the train between our stopping points, so please don't forget to bring the ladies for both trips. Now there is one place which will be missed on both these trips, and that is the sewerage purification plant, and as I understand it, the plant is not yet completed; the sceptic tanks are completed and in working order and in operation, but the filters are not completed—or constructed, and I do not think any steps have been taken to construct them yet. If there are any of you who would like to visit the septic tanks you will hand your name to the Secretary, Mr. Tillson, and he will arrange for a special trip to that locality, which is pretty well below the city. They have been obliged, for reasons we need not discuss, to carry the outflow considerably further down stream than they thought was really necessary, and they have taken advantage of that fact to put in or at least provide for a gravity system of disposal, so that the sewerage at the present

time empties into the septic tank, and will eventually empty in the filter plants. It will take too much time and will be too much of a trip for us to leave the train and go to see it, and therefore it will be necessary for those who would like to see it, to arrange with Mr. Kendrick for a special trip, who will be very glad to arrange a trip for as many of you that want to go. I think this is all for this afternoon, and we will now adjourn until 8 P. M.

8:00 P. M., TUESDAY, OCTOBER 9.

THE PRESIDENT: Gentlemen, if you will come to order we will start the programme, but we are a little bit late. The first paper on the programme this evening is on "The Municipal Control of Planting and Care of Shade Trees," by Mr. William Solotaroff, of East Orange, N. J. Mr. Reimer will read his paper.

MR. REIMER: Mr. President and Gentlemen of the Convention: If you will allow me to preface the reading of this paper by a little of my own experience I will do so. I have been in charge of the streets and sewers of East Orange for eleven years and for seven of those years it came under my part of the business to see that the trees were taken care of, and much trimming had to be done. I was continually an advocate for the city's control of the trees, the planting of the trees and care by the city, but the only care they got during those seven or eight years was such as we could give to them by trimming and cutting out the dead wood and getting clear of the debris. That was done pretty quickly, but we had no authority to plant trees, and there was only one set of trees which ordinance provided against, and that was poplars, and such trees as the Alianthus.

Our state within the last three years passed a law whereby municipalities might provide a shade tree commission, and I was very much pleased to have our city take it up and such a commission has been appointed. An expert has been provided who looks after the trees and I pursuaded him to write this paper for the convention.

THE MUNICIPAL CONTROL OF THE PLANTING AND CARE OF SHADE TREES.

BY WILLIAM SOLOTAROFF, SECRETARY AND SUPERINTENDENT SHADE TREE COMMISSION, EAST ORANGE, N. J.

The importance of having the streets of our cities well shaded with handsome trees is not questioned by anyone. A street which has its sidewalks lined with trees is always an attractive feature in any town of whatever size. Two purposes are thus served, one is sanitary, the other esthetic. From the viewpoint of health we need but recall a few well known facts. Trees help to purify the air by absorbing carbonic acid gas that is exhaled by man and giving back the pure oxygen he needs. Trees also help to modify the temperature of our streets. The normal heat of summer is still further intensified in cities by the reflections from the pavements and from the buildings. It is then that the benefits of the shadows cast by the foliage of the trees is best appreciated. The esthetic value of shade trees is very great. No city in America possesses such avenues of fine shade trees as the City of Washington. The trees of that place are held in higher estimation than architectural display, and while visitors admire the fine public buildings, everyone will admit that the chief attractions of Washington are the beautiful avenues of shade trees which make it one magnificent park. The task of planting trees on the streets of our cities and the problem of taking care of those already existing are matters of vital importance to all those who are interested in municipal improvements. The advisability of planting shade trees on the public highways is readily admitted. The only question that concerns us is one of method. How should this planting be done, and what system will assure us the best results?

In every city of the country where trees are most abundant and where they are most likely to thrive, at one time or other there arises the problem of taking care of those trees and of setting out new ones. There comes a time when a certain species of tree is attacked by an insect, when the trees along a certain street need pruning, when trees are to be guarded from horse bites and passing vehicles; or when it is desirable to plant a newly opened street. At the very writing of this paper, I received a letter from a citizen of Elmira, N. Y., stating that he had been requested by the mayor of that city to devise a plan for pruning, repairing and taking general care of the trees of that city. He asked for suggestions in the matter of organization and methods of work.

There are two ways by which the work of planting and caring for shade trees can be accomplished. The work must be done either by individual land owners or public officials. The prevailing policy of most of our cities has been to leave this task to the individuals who own the property on a certain street. The results thus obtained have been very unsatisfactory. There are no two people governed by the same taste in the choice of trees for planting, and as a result we usually find more

than half a dozen different kinds of trees on the same street, undesirable species mixed with desirable, set either too close or too far apart and left unprotected from injury. In one case the trees will not be trimmed at all and the limbs will be so low as to touch the head of the pedestrian; the neighbors' trees on the other hand will be pruned too high. A concrete example of the conditions as to shade trees on a street in East Orange, N. J., will illustrate the results accomplished by individual planting.

There are forty-five trees on this street. Of these there are seven white maples, seven horse chestnuts, eleven red maples, two American elms, eleven Norway maples, three sugar maples, one ash-leaved maple, two poplars and one linden. The trees range in size from two inches to thirty inches in diameter, and their distances on the street vary from 18 feet to 282 feet apart. Twenty-nine of these trees are rated good, seven are medium and nine are bad. Now what beauty can a street possess on which there are nine species of trees in all sorts of conditions, and widely varying in shape and size. The street described above is not an exceptional one, but is rather typical of the streets where private planting has been the the rule, and familiarity with the condition of the shade trees in many of the cities of the State of New Jersey makes it safe to say that what is true of one state will be true of another, and that the results accomplished by individual planting have been very unsatisfactory.

When there comes a time that a certain insect pest is to be combatted and the work is then left to the individual citizen to do, he is completely powerless to accomplish anything. He may plant an undesirable species of tree if the task is left to him, but in insect fighting he will do even less. His efforts will come to naught if his neighbor allows the pest to remain on his trees. In the extermination of insects in a city, it is absolutely necessary that all the infested trees be treated in order to obtain effective results. The insects spread very rapidly; in fact, it is even difficult for a city that has an organized system and apparatus for spraying trees to keep the trees entirely free after treatment if the neighboring cities do not check the spread of the pests. It is impossible to have concerted action on the part of thousands of people of a community in the treatment of infested trees at the same time. Insect fighting requires persistence and a knowledge of what to do at the proper time to obtain results. There is a period in the life history of every one of our tree pests when it may be most easily destroyed. This stage is not always at the time when the most injury is apparent, or when the average citizen wakes up to the necessity of doing something. The life history of the pests must be known in order that treatment may be given at the right time. The injury to trees by borers is a case in point. The foliage does not show the effects of the damage done nor do the limbs begin to die until three or four years after the caterpillars of the borers did their fatal work. Then the people wonder

why the trees are dying. Hundreds of fine sugar maples are dying every year in the northern section of the State of New Jersey, as a result of the ravages of the borers a few years ago. Attention to them at the time the insects were active would have saved the trees.

How little a citizen can do is shown by the condition of the private grounds and orchards in any city, even where there are organized bodies to take care of the shade trees. On almost all the trees on private land are found borers, aphids or plant lice, and a great abundance of scale and sucking insects. They remain and propagate from year to year, and if one man by persistent work succeeds in ridding his place of the pest one year, the next year his garden will be as bad again by the migration of insects from his neighbors' grounds.

We cannot blame the individual for these unsatisfactory results. We are seeking in regard to shade trees, at least, that which is for the common good of all, and we expect the work to be done by the citizens without instruction, without system, and leave to each one, if it so pleases him, to do his share when and how he pleases. It is the system that is wrong, and the remedy can readily suggest itself. Other municipal interests are vested in commissions, committees, or other organized bodies. It is felt that the matter of planting and caring for shade trees should be entrusted to a similar body and a shade tree commission should be incorporated in every municipality.

The idea of placing shade trees under the control of an organized body is not new and the results accomplished in cities by such provision have been so satisfactory that it seems surprising the system of municipal control is not becoming more general. All the trees in Washington are cared for by the city and all planting is done by city authorities. The new charter of Greater New York placed the shade trees under the care of the Park Department. The work done by that department, especially in the Boroughs of Brooklyn and Queens, has improved the condition of the trees very materially. The jurisdiction of the Park Department of New York extends only to the existing trees, and there are certain ordinances governing the setting out of trees by individuals. It has not the power, however, of initiative in setting out new trees either by a general appropriation or putting a lien on property the same as for any other improvement. The best solution, by far, of the problem of the planting and care of shade trees is provided by a law of the State of New Jersey, and as far as we know, it is the only law of its kind in any state in the Union.

An act of the laws of 1893 of the State of New Jersey provides for the establishing of commissions to take charge of the planting and care of shade trees on the highways of the municipalities of the state. These commissions are to be composed of three members, appointed for terms of three, four and five years, and are to serve without pay. It is optional with the governing body of any city whether this act shall have effect there. New Jersey, Newark, Passaic, East Orange and South

Orange are among the places that have availed themselves of the privileges of this act. All matters pertaining to shade trees in these places have been placed in the hands of the respective commissions. All work is carried on in a systematic way, and all trees are planted, pruned, sprayed and removed under the commissioners' direction. As practically operated, the commissioners serve as an organization, and they employ a professional man who has full charge of the executive work. Wherein these commissions differ from other similar bodies is that they have the power of initiative in the matter of planting. They decide that a certain street is to be planted and determine on the species of tree. An advertisement of the intention to plant is inserted for two weeks in the public newspapers. After the work is done the commissioners meet and certify a list to the receiver of taxes on which is given the names of the owners in front of whose property trees were set out and the cost of the work. This assessment is entered by the receiver of taxes on the annual tax bill and is paid the same as any other legal lien. The cost of pruning, spraying, removing dead trees and repairing old ones is provided by a general appropriation.

A brief review of the work done in East Orange, N. J., during the two and a half years that the Shade Tree Commission has been in organization will give an idea what has been done in all the cities of the state where the tree commissions have been established. About 1,300 trees were planted. The species chosen were the Norway maple. the sugar maple, the European linden, the American linden, the pin oak and the Oriental plane. Only one species of tree was planted on a street. These were set out at uniform distances apart and all trees were supplied with uniform wire guards. The advantages of such a system of planting can be readily seen. By selecting the proper species of tree for street use, hardy trees are taken of symmetrical habit, of well filled head, neither too open nor too compact. By placing the trees at proper distances apart, each tree is allowed to develop its characteristic beauty and when mature there is sufficient space between the outstretching limbs for the admission of light and the free circulation of air, so essential to health and comfort. Streets that have become famous for their beautiful shade trees, both in this country and abroad, are planted with one species of tree. This plan is followed in Washington, and the fame of Flushing, Long Island, as a beautiful suburb, is due to the fact that its fine streets are in the majority of cases planted with one variety. Setting out one species of tree on a street can be done only when one man or one body is laying out the work. An organized body in planting a street treats it as a unit, and selects a tree that is best adapted for the width of street, condition of soil and nearness of the houses to the street. By placing guards around all trees when they are set out, all injury from horse bites is prevented.

There are sixty-seven miles of streets in East Orange. The trees on about twenty-eight miles of those streets were pruned under the

direction of the Shade Tree Commission. In this work, too, the street was treated as a unit. All trees were pruned to a uniform height, a height that would permit the unimpeded passage of vehicles and would allow all street lights to be seen at night. All scars were painted with coal tar to help in the healing of the wounds.

By far the most important work done by the Shade Tree Commission of East Orange was the successful combatting of the insect pests among which were the tussock moth, attacking the American elm, the horse-chestnut, the white maple and the lindens; the cottony maple scale attacking the white maple, the wooly maple scale attacking the sugar maple, and the elm leaf beetle attacking the elms. As far as was possible, the idea constantly borne in mind was to fight the insects before they developed, and hence before great damage was done.

The placing of the control of shade trees in the hands of commissions is no longer a theory in the State of New Jersey. Those cities that have availed themselves of the privileges of the state act and have organized the commissions, are enjoying the benefits of the work of these bodies and other cities are taking up the matter. Considered solely from an economical standpoint this system of municipal control should commend itself to all interested in city improvements. A body planting several hundred trees at one time is able to select good nursery stock, get the trees at wholesale prices and accomplish work which the individual could not do at perhaps twice the price. The result is that there is no opposition on the part of the citizens to the improvements which the commissions in the several cities of New Jersey are making. The advantages of their methods are seen and assessments for newly planted trees are paid as readily as for any other improvements. The desirability of having shade trees, especially on residential streets, is now universally recognized. From all large cities people are flocking to the suburbs, and the desire to make these places as countrylike as possible is very great. Real estate people are aware that beautiful trees will increase the value of their property. Either through ignorance, however, or more likely through the desire for immediate effect—real estate people build houses to sell—they are planting the Carolina poplar and the soft maple to the exclusion of every good tree. Any one familiar with the new sections on Long Island, in the Boroughs of Brooklyn and Queens, developed by real estate firms, will understand what is meant. The Carolina poplar is the predominating species of tree planted. In a few years these trees will detract rather than add to the beauty of the places. As in the setting out of trees, the future rather than the present is to be considered, the importance of the question of shade trees in new cities is just as great as in those having old trees; and a body to take charge of trees should be established in every city as soon as the streets are opened and provisions are made for any other city improvements.

THE PRESIDENT: You have heard the paper and it is now open

for discussion. It is a very important question and I would be very glad to hear some expressions regarding it.

MR. WEISSLEDER: It strikes me that the methods described in the paper just read is one almost any municipality might establish, and there is scarcely a city in the United States or Canada that could not establish that method, because it is one that is simple in its entirety and could be of universal adaptability. The paper is certainly a good one and I have experienced some of the points the reader set forth; he mentioned some of the trees that are obnoxious, mentions the Carolina poplars. I live in Ohio and have some of them on my property and they are a miserable tree, and we had two of them blown down by a storm and we planted maples in their stead, and wish we had more of them destroyed in that same way.

THE PRESIDENT: I might say something about our method in Indianapolis. It don't go far enough. Some years ago we had the question of the control of the street trees under discussion, and finally had a law passed by the legislature creating the position of City Forester and the planting and trimming and taking out of all trees in the streets of the city and public places was put in the hands of this forester. The park board had the appointment of the forester and the park superintendent has always held the position. Theoretically it is a very good proposition, but practically it has not amounted to very much, because the park superintendent has always felt that he did not have assistance enough and did not have money enough to perform that duty in addition to the regular park work, which has always been very slow on account of the lack of appropriations, and they have had so much other work to do that they had not taken very much care of this particular thing. But practically it has reduced itself simply to the matter of issuing permits for trimming trees. My next door neighbor, for example, has two of the Carolina poplars and his next door neighbor has one of them, and he has between his two a couple of very little maples and I have been after him to get out those two Carolina poplars, but I have not been able to get him to do it

yet. If we had a shade tree commission, or if the city forester would attend to his duty, we would soon have those two trees out. My friend seems to want them out, but is afraid to do it. I happen to be the president of our local Civic Improvement Association and we have recently had brought to us a case that may be of interest and some may have something to say about it. We all have difficulty with the linemen of the different telephone and telegraph companes trimming trees they have no business to touch. We had a very flagrant case of that three or four weeks ago, where they went on private property belonging to two colleges and took out two very beautiful elm trees and practically destroyed two others, and we have been trying to place the responsibility for that damage. The universities' friends have brought suit against the linemen who did the business, but I don't know how much they can ever get out of them for it, and the matter was referred to our Civic Improvement Association. I came across a paper which had been written by a lawyer for the Iowa State Association in which he went into the question of the ownership of the trees in the streets, and he finally decided that the property owners actually own the trees, but they have not very much to do with them; that the city has control of them; that the city can do anything it likes with the trees within reason and that this entire matter ought to be taken in charge by the city. I believe there was one case in which the city was sued and a judgment was obtained because it had cut down a couple of very beautiful trees in front of the property of a certain tax payer, and that showed that the city didn't have complete control, that is, it could not remove a tree which belonged to a property owner, but it could regulate it. We took up the question of the responsibility for the damage to trees in the street. It is usual for the proprietor of the telegraph line, or telephone line, to say that he has issued orders to his employes not to trim the trees, and, therefore, the company is not responsible for the damages done. It didn't seem to me that that was very good law; it certainly is not very good sense. Why, they say to their employes they are not to trim the trees, at the same time they give them imperative orders to put the line through and not have it

interfered with by anything on the street. The two orders are entirely at war with each other and one of them has to give way. Of course the one gives way which the employe finds the least trouble with. Consequently he goes ahead and trims the trees any way he likes, and in our latest case it took an axe to bring him out of the tree and a good strong man behind it who threatened to knock him out of the tree. Our present proposition is to bring suit against the telephone company itself for damages to the trees. If we can succeed in this we think we are in pretty good shape to take care of the trees. Of course we will have the responsibility for the damages definitely placed, and we have a responsible head who has charge of the trees, and if we can only make him do his duty we are satisfied we can take care of our trees in very good shape. I think the plan which is in use in New Jersey is excellent, and in practice I presume it works out better than our own proposition, because they have at least a public spirited commission which takes care of the work that is given to it. We have a municipal official who is loaded up with the duty additional to the duties he already has and is not given additional assistance and additional money to take care of his new duties, and he neglects it. That is the advantage of the New Jersey system over ours.

MR. WEISSLEDER: I might remark that while I had charge of matter in Cincinnati the limbs hung very low. I referred the matter to the corporation counsel and explained the situation and he made a ruling that it was proper for the authority having charge of the matter to attend to it. If any obstruction appeared on the street we had a right to have it removed. We gave instructions to the gas company to trim the trees to a 12-foot zone. Where there was a light the center trees didn't offer any obstruction, but those in the immediate vicinity of lamps were trimmed. The wires carrying the currents for such lamps had injured a number of trees, and property owners protested and came to my office and said they were going to sue the gas company for damages for damaging the trees. I advised the people that the case would not stand the test of the law, because the function of the board was to light the street and that it was carried on by means of electricity

and if they run through the trees and the owners didn't permit them to trim the trees they would be damaged, and I advised them to let the trees be trimmed, consequently we had no more trouble. In the matter of commercial wires, that was another thing, and I advised that they arrange that satisfactory to themselves. When it come to commercial wires they had no authority so far as trimming trees was concerned; in one case it was a public duty and in the other it was a private enterprise. These members will understand the difference. I advised everybody to permit the trimming when it is properly done, and not do as the gas company did in one case. The man wanted to cut the dog's tail off, but cut it off close behind his ears. They cut them down so low the gas company had to pay a large sum of money, so I was informed.

MR. CHRISTY: I don't know whether the Convention would care to hear anything in regard to our tree business, but I rather think our little city has been in advance of many others in regard to caring for their trees. One of the features that came under my control were the trees for a good many years. There are laws provided that no one should do any damage to any trees on the street. If we discoveerd that any telephone or electric light company or trolley line were mutilating the trees we haled them to court. We stopped that business very quickly. In other instances where they chose to brace their lines up by putting wires around the trees, a notice was sent to the offending companies that the wires must be removed and if they did not they were notified if they did not remove them in a certain number of hours they would be taken out, and that generally brought them to terms. We were in pretty good shape so far as law is concerned, to handle them, so had little difficulty. The chief difficulty and one that we found a good deal of trouble in removing was where large feed wires had been drawn through the trees. While the companies would protect their main cables with wood shields, as the tree was swayed, the bark would be rubbed off and we got them to put the protection on the tree instead of the wire, but a good many of our trees were seriously damaged. There is one item in that paper on which there might be some question raised ,and I would like to ask how the tree commissioner

has gone to work. Mr. Solotaroff has stated that by the buying of a large number of trees and planting them the work could be done cheaper than by the individual owner. At first sight it would appear absolutely false that the cost of planting our trees would be more than the ordinary owner would pay. The commissioner has made a ruling that the tree should be planted in good soil, and if it is not good they excavate a hole and fill it with good soil and plant the tree in that. Ordinarily the citizen don't do that; he hires a man to stick it in and that is the end of it. Our plan has been entirely different from that and our trees are growing very fine, but they cost a good deal more than $1.50 or $2; the average price is perhaps $5 a tree, but the method in planting assures success.

A MEMBER: Does $5 a tree include the protection?

MR. CHRISTY: The protection costs about 60 cents, a wire with a mesh around the tree about six feet high. So far we are well pleased with the work. It is doing very good work and we are satisfied today that it is going to be all right.

MR. HATTON: Mr. President, that paper appeals to me very much. It is a new idea to me and it looks to me that it ought to appeal at once to a large number of municipalities. I know how it is in our city with which I was connected for a good many years. We had all these tree troubles that the paper speaks of and which these other gentlemen speak of. Our city is a city like East Orange and other cities of Northern New Jersey and the streets are full of trees. There is one point in that paper which particularly struck me, and that is the distance which trees are planted if left to private thought. For instance, there are many illustrations and I think every member here who is interested in cities will find that that is true. If a man has a lot 25 feet front, one tree is not enough for him and he plants two trees in that 25-foot front, perhaps the greatest distance is twelve or fifteen feet apart, and the next man wants to do the same thing and plants two trees, and that has occurred all over our city until the trees are dwarfed because they have not had sufficient room, one side is flat and the

other side is round. This idea of municipal control over the planting and trimming is a splendid idea. I am glad to hear it read.

MR. CHRISTY: Mr. Hatton touched upon the idea about the man planting two trees. He not only had the trouble of making the space too small, but there comes along another man five years afterwards when those two trees planted have a fair growth and he wants to catch up with the first one, and so plants a couple of lombardy poplars, and that is the way it goes. Here we have a couple of maples with hardly room enough for one good tree to grow. Our great trouble with them is the condition in which they leave the sidewalk. It has been necessary for our board in the last year to hire special inspectors to go over the town on account of the bad sidewalks caused by these poplar trees. About two years ago they adopted an ordinance preventing the planting of any more of them. The people are beginning to appreciate that they are a bad thing, but the reason they were put in was to save time. They have also had a great deal of trouble with them; they seem to hunt water. We have had half a dozen cases this year where sewers had to be taken up to get the roots out, which would be entirely filled, and it seems to me the first thing a city wants to do is to regulate the tree end of it. So far as the cutting by the wires of the electric company is concerned I think we have had as much of that trouble as any city in the country. One of our directors was away a couple of weeks and had a couple of nice trees. Before he went away the electric company said they would like to do a little trimming and he gave them permission, thinking that they would use some judgment, and when he came back he said he didn't know the trees, was not quite sure whether he was at his own home or not. But they have started in trying to control the wiring companies by making them use a very high pole so that they will try to clear the best part of the trees anyhow.

MR. WEISSLEDER: I want to make a suggestion to some of the members who reside in cities large enough to support a newspaper with large circulation, to go to work and have the newspaper solicit

funds, as was done by the Tribune in Cincinnati ten or twelve years ago to plant trees on Gilbert avenue, which was built by cutting a shaft on the hillside. The Commercial Tribune raised enough money by popular subscription to plant trees and provide each tree with a wire tree box, but I suppose the Convention will not agree with the forester when I tell them that all these trees were unfortunately poplars, because they were quick growers and afforded shade in a very short time. So if anybody has a newspaper that they want to give them a pointer to do with, that would be a very good idea.

MR. REIMER: I might say that the average distance apart we are planting our trees is 35 feet. I would like them a little wider apart, but 35 feet is a fair distance and any of the maples will cover that space when fairly grown very nicely and not run a chance of destroying the top of the tree.

MR. HATTON: You don't vary that distance according to the kind of tree?

MR. REIMER: Slightly so, but the average distance is 35 feet.

MR. WEISSLEDER: What will a man do who has a neighbor with 25 feet?

THE PRESIDENT: We have lots on our street which are about 40 feet wide and we have a little grass patch in front of the house, which, inculding the width of the sidewalk, would permit us to set three trees and have them 35 feet part and still not up too close to the house by setting them in a triangle. If the setting out of trees inside of the lot as well as outside enhances the city property we can give each man three trees, and have two rows of trees the whole length of the street. But if we don't have some control that way we are liable to throw two trees in front of each lot and crowd them. I have two trees in my lot and one on the sidewalk, my next door neighbor would have two trees on the sidewalk and one in the lot.

MR. HATTON: I would like to ask the speaker just one thing: You say you plant them about thirty-five feet apart, now suppose

those lots are 25-foot lots, every man cannot get a tree on his lot, but you assess the cost of that as a whole?

MR. REIMER: I believe that is the case.

MR. CHRISTY: And he gets the telegraph pole, don't he? (Laughter.)

THE SECRETARY: Mr. President, some reference was made in the paper to the park commissioner in the City of New York having control over the trees. He does have control to the extent that when the bureau of highways improves the streets, if any tree is in the way, and has to be cut down, the park commissioner must give his consent to the removal of that tree before it can be touched. That might cause some trouble if the two departments did not work in harmony, but at the present time we think they harmonize very well. While it takes some red tape and takes time, still I think the results justify the extra work. There was one statement in the paper that might be right in the abstract, but it would create a wrong impression. If I remember right the paper stated that the park department had no right to put out new trees.

MR. REIMER: On streets?

THE SECRETARY: That is not so; they have not a right to put out trees and makes an assessment for payment, but so far as their appropriation will allow them, they do have the right to set out trees. A notable instance of that was two years ago when we improved Fourth avenue, a street which was paved with asphalt for about four miles. For the greater portion the roadway is 70 feet wide, a park 20 feet wide in the center, and 25-foot roadways on each side. The park department treated it in this way: They took the first mile and set out maple trees along the curb and on both sides of the park in the center; the next mile was treated with elms, and the third mile with oaks, the idea being to give uniformity and at the same time variety. Of course, if you have a mile of the street of the same kind of trees you get uniformity, and if you have a street three miles long and have three varieties, you get variety. Unfortunately a great many of the trees died, although they were

set out carefully and top soil was put with the trees. Of one variety almost every individual tree died.

MR. REIMER: The oaks most likely.

THE SECRETARY: I am not positive. The park department has complete control over the pruning and trimming and no individual or corporation can trim any tree without getting permission from the park department.

MR. HATTON: Or plant any tree?

THE SECRETARY: No, sir. The question of who has jurisdiction over the trees depends on what the city's rights are in the streets. When Brooklyn was a city by itself, and a street was opened, the actual title was not taken, but only an easement for street purposes. Now the courts have decided that does not give the city exclusive ownership of the trees, but since consolidation, the acquirements of all streets has included the absolute title to the street itself for whatever purpose used, consequently the city has complete control over the streets from property line to property line in any street that has been acquired since Jan. 1, 1898. We had an instance the other day where the park department had given some one moving a house the privilege to trim some trees in the street. A property owner was somewhat unfavorably disposed toward the proceeding and went into court and stopped it. How it has finally been settled, I do not know. But this was on a street that had been acquired by the city before consolidation and the city did not have absolute title to the street. I appreciate very fully the action of the real estate owners referred to in the paper and also some of the others in planting Carolina poplars. That has been done to a great extent in Brooklyn, and for the time that they have been planted they certainly give first class results. They make a pretty tree, grow rapidly and improve the street very quickly, and while I never thought they were very desirable trees, I did not suppose they were as undesirable as many of the speakers state. It is practically impossible for the city to control that phase of the subject for this reason. We have in Brooklyn a situation which I never have seen elsewhere, and that is a great many of

the streets are built upon and improved before the city has any title to the street at all, and until the city has the title to the street, of course, they can have no control over it, and in that way they plant whatever trees they please, and as they please. It is a fact that on our petitions for new improvements in the outlying sections of the city that out of the streets asked for to be improved fully one-half are not open streets technically, although in many cases they have houses built upon them, some as long as fifteen or twenty years. In that case the matter is taken up and examined by an engineer and a statement made as to the condition of the street, and this statement is submitted to the corporation counsel and he examines the conditions personally and then decides whether in his judgment he thinks it is safe for the city to go ahead and make an improvement on that street. The importance of it is that all of our early improvements, including grading and curbing, is paid for by the property owner, and if the city should improve a street and the courts decide it had not sufficient title it could not collect the assessment, and the city would have to foot the bill.

MR. WEISSLEDER: In speaking about the obstruction and improvement of the streets, what obtains in our city is about as follows: The resolution to improve emanates in the council of the leading body which designates the width of the street. If there are any trees there the trees suffer, and in one case a street was improved that had old silver poplars on it for a distance of nearly two miles, and they cut down every single tree. It was a toll road and was acquired by the city and had a line of street cars on it, and the street car tracks were laid close to the trees and the middle of the roadway was used as a speedway, and, of course, in the improvement of the street the street car tracks were put in the middle and every single tree, or nearly two miles of trees, were removed and no trees planted in their stead, and, of course, there is something that is missing, viz.: the shade, but being almost exclusively a manufacturing district, the absence of the trees have not caused much suffering, because the factories want all the light they can get. The power rests in the board of public service.

Recently a case came up where the property owners protested, because the street was to be paved with brick, and the question came up why they could not narrow the roadway. One-fifth of the street is set apart for sidewalks, and the street is set according to that rule and the result is that the tree is generally cut down. to set the curb but sometimes the tree will be sitting with a shoulder on the curb and after a while the hubs of wheels finish the tree and it dies.

MR. PARKES: If it is necessary to cut down the tree we had better move the street. I am speaking from a little experience on that line. You can build a street in about thirty days and you cannot grow a tree in thirty days to save your life. I have been out in the woods, but I have been building some brick streets, and we have some beautiful trees. They are sycamores and they are the worst trees in the country to shed their leaves. But I will tell you right now a tree is the dearest possession that a property owner has; he will fight for it until the last breath and be taken into court on it, and he ought to, and if he can beat you he ought to do it, because you can put everything back there but that tree; money won't buy a tree. If you can build your street around that tree, built it around it; if you cannot build your sidewalk up—I built one. I have got sidewalks right there, gentlemen, that are three feet above my curb grade, and I have got a pretty good grade on that street, and my sidewalks are above that. Why, not because I believe it is a good idea for the sidewalk to be three feet above the curb, but because I believe the tree improvements more to a man than six inches of roadway, and when you can save a man's tree by moving a little to one side, why, move to the side and save the tree.

MR. WEISSLEDER: I agree with the speaker that the tree is a precious possession; nobody denies that, but when you come to measure the necessity of the case the matter of a mere tree ought to have but litte weight. In building the sidewalk I understood him to say he built the sidewalks higher. What could the city's rights be if a pedestrian fell and injured himself? The man

would have a claim against the city that permittted the sidewalks to be built dangerously. Nobody would deny that claim. The city is liable, and therefore the city is bound to protect the public, and build its sidewalks and streets so that they can be used safely by pedestrians; the matter of trees is largely a matter of sentiment; the safety of the public comes first, but the other considerations may follow. Of course, save trees where you can, but cut them out where it is necessary to establish a curb line. I know of a place where a sidewalk was built around a tree, and when the suburb was annexed we had those conditions to contend with. It is a nuisance, and on a dark night a person is liable to run into it and the matter of a tree should not enter into the matter of giving the public proper walks to walk on.

THE SECRETARY: We do everything we can to preserve the tree. We have an ordinance, for instance, on a sixty-foot street, making the roadway thirty feet. I had a case sometime ago where to put the street at the regular grade and curb line would have destroyed the trees on each side of the street; we changed the roadway and grade. We raised the grade and brought it so near the top of the ground so much so that it was not necessary to disturb the trees. In regard to the building of sidewalks above the streets, in New York this would get us into complications, because all that kind of work is assessment work, and if the street is not carried out according to grade the property owner could dispute his assessment, and the engineer would get into trouble with the law department. There is another trouble. A property owner owns perhaps a hundred feet on the street, and asks that his sidewalk be left above the street. Then suppose after the assessment is made, he sells that property and the new owner comes in and says he wants that property cut down to the curb grade, the city would have to do it, and pay for it out of the repair fund.

MR. HATTON: Take it out of the engineer's salary.

THE SECRETARY: No, sir. Where the work is done by assessment proceedings, you have to be very careful, and do a great many things which you would say was not common sense, but really the engineer cannot take any chances.

MR. PARKES: What I desired to say was simply this, as I said a few moments ago, we don't all work in New York, and I work where laws are different from yours, entirely different. The assessment proposition is not local with us. The city cannot make an improvement in my state at all. It is done by the property owners themselves. There is no way on earth that a man in our town can make the city lay his sidewalks. What we could do or what we could not do about a grade was not what I rose to speak of at all, but a tree is the most valuable possession a man can put upon his place. It is not a question of a man's falling over himself; if he wants to fall over a tree let him fall over it; and if he wants to fall over a fence, let him fall over a wire fence. I have got a sidewalk two and a half by three feet high, and it is not hard for an intelligent man to walk that. It don't require any special intelligence to do that, a sidewalk is an easy grade and he can do it. The other day I went up against this proposition: I sent my assistant out to stake a sidewalk, and he came back and said the man has got a shot gun after us, and we cannot lay that sidewalk, and I said why, and he said "You will cut down a tree." They were laying a five-foot sidewalk, and a tree in the middle of it. What are we going to do with it? Cut it down? I didn't. Spread it out two and a half feet and go around the three, and if the brother don't know the way to get around that tree when he goes home, I have got a police force over there to kindly take him by it.

THE SECRETARY: I did the same thing as that myself, although I made the walk over two and a half feet, about four feet on each side, and the owner of the property was glad enough to pay for that extra walk to have the tree preserved, but there is one thing the gentleman don't think of. We have men in New York who are not very intelligent when they go home, and if they knew there was any danger on that sidewalk and that sidewalk has not been put to grade properly, the man would have a valid claim against the city, and could collect it, and I would get a very strong call down for allowing the street to be built that way.

MR. WEISSLEDER: I am a little surprised that Brother Tillson speaks of the inability of the engineer in grading the sidewalk. That is a thing that I am nonplussed over, for the engineer is certainly the mechanic in charge of the work and he ought to establish the level of the sidewalk in that particular locality. We are in a small town in the interior and do things probably different from the way they do in the Metropolis of New York, but if a property-holder in grading a street suffers any damage by changing the altitude of the sidewalk, and he has to walk four steps in lieu of one or two, he is paid and it comes out of the appropriation to improve the street. There have been many retaining walls built in Cincinnati as high as twenty feet, where a mountain was cut down to change the grade, to better property conditions, and the man who butts on that property gets damages, but what has he got to do? He has some physical labor to get up and down to his house, and that cannot be expressed in dollars and cents alone.

THE PRESIDENT: Perhaps we are getting a little off the subject, and this matter has been gone over pretty thoroughly already, and as we have two papers yet to read, we will go on. Mr. Crandall, of the Committee on Taxation, has not arrived, so we will pastpone that until he arrives. The next is the report of the Committee on Municipal Franchises, by Mr. Weissleder.

MR. WEISSLEDER: Mr. Chairman, in appointing that committee you no doubt felt that you had material from which to select those to be entrusted with that work, but I must confess that owing to the illness of Mr. Barrow, and Mr. Rust's absence in Europe, a great deal of the time, I have a good notion to let Mr. Rust read the memorandum I have prepared. It is hardly to be called a paper, but simply a sketch outline of some thoughts, and this convention can take it up and discuss it, and see if we cannot get more trees planted along the line of progress. We all no doubt have had experience with franchises, some in participating in some of the benefits that flow from their possession, and some perhaps in construing the rights of the grants, so I beg the indulgence of my hearers in presenting this paper or rather what is called as such:

MUNICIPAL FRANCHISES.

BY L. H. WEISSLEDER, CINCINNATI, O.

I beg the indulgence of my hearers in presenting this paper, or rather what is offered as such, as the subject can be viewed from several angles, and the one I have chosen will, I believe, be new to some who have probably not witnessed as we say "Trying Times," in the struggle for existence by some individual or corporation that had accepted an "Abstract" franchise grant and tried to convert it into a "Concrete dollar; who has not seen wrecked fortunes and hopes along the highways or financial public service endeavor."

The possession of a franchise granted by any municipal legislative body to permit corporations or individuals under statutory authority to engage in any business in which all or part of said business plant must be erected and operated along public thoroughfares or other public places, presents several aspects as to its value:

1. Dependent on its tenure of life.

2. The conditions as to amount of money paid to the municipality for all or part of its life (called for convenience a franchise tax) or its equivalent in services, conveniences and benefits dependent on the nature of the business carried on. If such franchise can be curtailed or nullified in an arbitrary manner when certain stipulations are embraced in the original grant, that may be construed by different legal minds to have opposite meanings in which case the trials, tribulations and anxious moments of the public utility man certainly obtains, as the public is usually taking sides on these questions fostered often by a sensational press which seeks to spread ink on large type rather than to fairly lay the issue before its readers. As considerations of equity do not always enter deeply in this discussion by one side of the public (and sometimes the press) there is always the danger of unfair moves (through public clamor) by the hostile interests, that may partake of either a political or sectarian character, and sometimes neither, but rather a battle of financial giants with the public, however, still taking sides without a single sign of benefit or gain in any way; but just because the public "dearly loves a fight." These contests, however, often leave an unhealthy aftermath in the community in that it is apt to create the feeling that a victory no matter by what means it is won, is a thing to rejoice over, thus blunting the sense of right and justice, and the members of this assembly are perhaps only too well aware how near home there stands recorded some of these happenings, either in a mild form, or probably in a serious and almost revolutionary degree.

Let us look at the question from the standpoint of an unbiased observer. Suppose a corporation that is properly chartered and amply financed and in the possession of a grant to carry on certain public utilities within the corporate limits of a city of, say, 300,000 inhabitants. The municipal franchise being duly granted under the laws of the state in

which said city is located. The corporation having complied with all the statutes covering its operations, carried out all of its local franchise obligations in every year of its existence and in every other way, has properly conducted its business, and whose rights were never questioned; meeting the public demands from time to time as occasion indicated. Now, by this standard of performance we measure the rights of this corporation as being superior to the assumed or alleged rights of a group of men who make a great display of professed love for the "public," who are "being robbed" by said corporation, that it is attempted to supersede by appeals to the public through the press and to the legislative body having the power to grant privileges, that if this group of men are only given a franchise to engage in the business, that the corporation above cited is conducting, that unlimited benefits would follow such action. Now, the unbiased observer would naturally ask what are the reasons prompting these men to want a franchise that would involve the construction of an entire and complete physical plant of like character operated by the corporation they covet to rival by competition, when if they desire to earn money on an investment, why they don't invest in the stock of the "Going concern," and thus save themselves time required by construction and the necessarily long period after starting up to have an income representing a fair return on the investment. The answer is,—well, you all know, and it is not given here as it is *obvious.*

If, however, a corporation, as per example, the one cited herein, defaults in any material obligation of its franchise and refuses or neglects to repair any such breach of contract when demand is made so to do by the properly constituted authority, and an aroused public demands that either a full compliance with its charter and grant be vouchsafed, the grantors, or, else the franchise will be annulled, also makes the answer easy when the question of right and equity is propounded.

The public is not averse to maintaining the integrity and permanency of a grant if good faith is shown by the grantee. There are times, however, when the grantee appears delinquent for want of a thorough knowledge of all the facts in the case, as very few, if any grantees would knowingly or wilfully impair their standing or jeopardize their rights, and when this disposition is quite manifest strong and unmistakable public sentiment should support the grantee in the enjoyment of its privileges. A proper respect for vested rights is due the grantee, when its business is conducted along the lines of honorable commercial dealings.

This then brings us to the question of what can this organization with propriety do to create a healthy public sentiment which shall aid in preventing hostile attacks on legitimate vested interests that are not delinquent or have not defaulted in any obligations to the grantors.

MR. WEISSLEDER: Now, Mr. Chairman, that paper is open for discussion, and I would like to see time spent on it to discredit my position in the matter.

THE PRESIDENT: The paper is now ready for discussion.

MR. REIMER: Mr. Chairman, I would like to ask the gentleman whether he knows of the public service corporations who are honestly, fairly and legitimately carrying on their business for the benefit of the public as well as themselves?

MR. WEISSLEDER: Mr. President, I might answer that question by saying that I have heard, and he doubtless has heard the many sides of where a corporation was not living up to its obligations. It is common rumor, it is passed about in the press by playing shuttle-cock and battle-door with it, and I will say so far as the conditions obtain in Cincinnati, I do not believe there ever has been a fair effort made in good faith to discredit the work done by the corporations. You take the gas company or traction company or the Bell Telephone Company, the Steam Heating Company, they got a franchise, and they live up to their obligations by placing something in the streets of Cincinnati. They selected an alley and placed a couple of pipes in there without connection, without any boiler, without any heating system, and there it lies, and that is the one case where the corporation did not carry out its promise, but on the other hand, the telephone company, which I have the honor to be connected with, has carried out all its obligations and more. It has voluntarily reduced its rate; it has taken the public into its confidence and the late Governor Stone declared in public that this business is a monopoly, but what we want to do is to conduct it so as to get business, and instill good sentiment, and that has largely been done during his life time, and his successors are doing likewise. An attempt was made three years ago by some gentleman that sought a franchise in Cincinnati and appealed to the legislature for it, and they had public hearings on the matter, the committee sounded the public on the question of a rival telephone company in the city, and the consensus of opinion was that a competing company was not needed. The council had public meetings and finally decided to table the application. The result was that they appealed to the probate court, which under the Ohio statue permits a corporation seeking a fran-

chise when it cannot agree with a municipal body to appeal to the probate court. That has been done in a number of instances—in five instances of electric light companies having five franchises. They sought the probate court, and one of its obligations that they said should be imposed upon themselves was that all their wires in the business district, embracing about four miles, should be placed under ground. The probate judge gave the matter a hearing, and decided that the company was entitled to a franchise, and that was appealed by the city, and went to the circuit and supreme courts of Ohio, and in each case the probate court was reversed, because the statute enacted in 1854 provided certain class of construction which could not be constructed to mean underground conduits and wires at that time, but in 1893 the State of Ohio passed a law enabling telephone companies and telegraph companies to bury their wires by laying conduits under the streets, a telephone company having an exchange doing business. That, of course, made it possible for the local company to get proper permits from the city authorities to open streets, which it did, and there never was a protest; it took down miles of poles. Before the cable was in vogue the streets were pretty well filled with telephone poles, filled with ten or twelve cross-arms. That has now practically all disappeared. It is disappearing gradually and being done because the company believes in the betterment of its plant, and giving the people the benefit of good service by burying its wires, and in that manner serving the interest of the public.

THE PRESIDENT: The only paper remaining on the program this evening is on Municipal Situation in Canada, by Mr. H. Bragg, of Montreal. The Secretary has the paper, and if you like, he will read it.

THE MUNICIPAL SITUATION IN CANADA.

BY H. BRAGG, MANAGING EDITOR CANADIAN MUNICIPAL JOURNAL.

Mr. Prcsident and Members of the American Society of Municipal Improvements:

Last year I had the honor of giving a lantern lecture on "Canadian Cities" before you at the convention in Montreal, and should have been delighted if it had been possible to accept the kind invitation to read

a paper before you this year, and thus be in the position of renewing the very pleasant friendships formed last year. As this is impossible, I feel gratified at being asked to send in a paper to be read along with the other much more valuable ones.

To give even a brief idea of "The Municipal Situation in Canada" is a more difficult task that at first appears, when it is remembered that the area of the Dominion of Canada is larger than that of the United States, although the population—as yet—is so much smaller; and that the conditions of municipal organization and appreciation are very varied and far from being completely developed in different sections of the Dominion.

Speaking in general terms, the three eastern provinces, Nova Scotia, New Brunswick and Prince Edward Island, follow the model of British municipal organization, even the titles of the officials being in many cases entirely different from those in use elsewhere; for instance, the Recorder, (previous to a recent change in one city, Halifax, N. S.), is the same as the City Solicitor in other Canadian cities, and has no judicial functions, but sits beside the mayor in the council, giving rulings on points of order, and opinions on the legal merits of the questions under discussion; while "Common Clerk" is the title of the City Clerk in St. John, N. B., which also has a Chamberlain.

The municipal organization of the Province of Quebec is the result of a very gradual growth since the time of the French *regime,* and has been evolved from the practice of England, with some admixture of the old French manner of doing public work, as has been shown in an exhaustive article by His Honor, Recorder Weir, of Montreal. The municipal code of the Province of Quebec contains some provisions to meet local requirements that must appear strange to those who are unacquainted with the country; among these are clauses providing for the construction and maintenance of ice roads across the rivers between municipalities, with the proper number of *belizes,* or small pine trees to mark the road; also the rules for the calling out of advertisements at the door of the parish church after morning Mass on Sunday, and the judicial sale of property at the same time and place.

The municipal laws of the Province of Ontario are based upon those of Great Britain, but contain modifications adopted from the more modern practice obtaining in the United States, although, very wisely, the plan of electing the technical officials of the city, as well as the judges has been carefully avoided. This principle of making such positions as the clerk, solicitor, chief constable, etc., absolutely permaennt is believed in all over Canada, and has everything to recommend it. Then the powers of the mayor do not correspond with those across the line, but are more in accord with the system in England.

The western provinces have followed the municipal organization of Ontario pretty closely, so far as their newer and less complex needs have

arisen. It may be noted that Manitoba has adopted the very simple system of land transfer in use in Australia, known as the Torrens system.

It will thus be seen that the various provinces, or at best groups of them, have various systems of municipal organization and laws. And up to seven years ago there was no united feeling or action among them, with a view to mutual improvement, or the securing of amended legislation of the federal laws. It must, however, be stated that the municipalities of the Province of Ontario to a certain extent had formed a Provincial Association as early as 1899; but they had made no effort to spread the idea among their sister municipalities in the other provinces.

Meantime, as will be easily understood, the franchise grabbers and charter mongers had enjoyed an easy time, and had managed to secure a great number of valuable concessions from the federal parliament at Ottawa, and the provincial legislatures, there being only spasmodic and isolated individual opposition.

Foremost among these concessions was the franchise secured by the Bell Telephone Company of Canada, giving them free access and full control of every street and highway in Canada. without requiring them to obtain the consent of any municipal authority.

As has been invariably the case, the greed of these monopolists led to their downfall. The attempt in 1900-1 of the Royal Electric Company (now merged in the Montreal Light, Heat & Power Company), to secure exorbitant powers led to a rebellion and one which has proved far more important than seemed possible at the time. The then Mayor of Westmount, a live municipality, adjoining Montreal—Mr. W. D. Lighthall, felt that some move should be made to oppose such legislation and secure a small measure of liberty for the municipalities before it was all legislated away. Consulting the late Oliver Howland, then Mayor of Toronto, he found that the same spirit of revolt was alive there, and the issuing of circulars and notices in the press brought some staunch supporters to the side of the founders. A meeting was called in Toronto, and an association formed to embrace every municipality in the dominion, whether large or small, called the Union of Canadian Municipalities, with the avowed aims of mutual study towards improved methods in municipal operations; the improvement of municipal legislation, both federal and provincial; and united action and co-operation in resisting oppressive legislation and the encroachments of private corporations. The union has greatly increased in influence since its inception, and has become a potent factor in the federal and provincial house, while its value and services have been acknowledged by special votes passed by many towns and cities. Two instances may be cited. The first is the change in the Railway Act, by which the control of the streets and roads, which had been taken away from the municipal authorities, is restored to them; and this applies not only to the large places, but to the rural districts also.

Before referring to the second great victory of the union, it may be remarked that the policy of the founders of the union was to secure

the formation of provincial unions, formed of the municipalities in each province, who would look after those matters relating solely to the province, and work with the federal union in questions pertaining to the whole country. This has been so successfully carried out that only two provinces at the present time have not formed provincial unions, and both of them are discussing it.

In securing the most recent victory then, the federal unions had the advantage of the active support of those provincial unions, as well as the special support of three of the provincial governments that are in close sympathy with the work of the unions; besides which some of the large cities were specially represented. So that the federal union presented a pretty strong front at the end of a six years' campaign for the rights of the citizens against the Bell Telephone Company. The position of the struggle, briefly, was that the company has secured from the dominion parliament tremendous powers, and that these powers, having been disputed by the City of Toronto, had been declared legal by the privy council—the highest court of appeal in the British Empire. Proceeding to exercise these powers after the usual style adopted by a monopoly, the company had driven the citizens to seek for some chance to curb them. This opportunity was found in the application of the Bell Company for further powers and liberty to increase its capital enormously. In this the union found the long-looked-for chance, and opened up the fight, arranging for a deputation to wait upon the Prime Minister, which was the most important one that ever went to any Canadian government, because it represented the whole people of Canada. The result was that legislation was passed curtailing the powers of the Bell Company, and restoring to the municipalities at least part of the control of the streets which they had previously lost. and this in spite of the fact the Bell people spent $150,000 in opposing the union. As a result, the company cannot tear up the pavements and erect a forest of poles without asking permission of the local authorities, and the whole question of what they want is placed under the railway commission, which has power to prevent any injustice being done.

The telephone situation is further simplified by the action of the government of the Province of Manitoba, which has decided to build a governmental long distance telephone system, and to guarantee the bonds for any municipal system; while the recent convention of the Canadian Independent Telephone Association proves that the independent movement is making rapid headway in Canada, as it is in the states.

It will thus be seen that The Union of Canadian Municipalities is a force that must be reckoned with in any discussion of municipal affairs in Canada.

In civic government, Toronto has led the way in adopting a board of control in addition to the mayor and aldermen. The controllers and mayor are elected by the votes of all the electors, while the aldermen are elected by separate wards. The board, of which the mayor is *ex-*

officio chairman, prepares the business for the council, in which they have seats and votes, thus taking the place of committees. They receive a fair salary, and give a good deal of their time to the business of the city. As a result of Toronto's experience in this matter, Winnipeg has decided to adopt the same plan, and Montreal is discussing it also.

Municipal ownership does not obtain very largely in the eastern, or older provinces, except in the case of waterworks, which are generally owned by the municipality. At the best, a revenue more or less (and generally *less*) adequate is obtained from other privately owned utilities as a trifling return for the value of the franchise which the citizens have given for nothing, and which they give value to. Montreal, for instance, gets absolutely nothing for the franchises for gas and electric light, the prices of which are exorbitant; and only a small amount from the street railway company. Toronto is better off, as her income from the street railway is over $400,000 a year as her share of the revenue, and yet the company pays 6 per cent. on its well watered stock of eight millions. In too many places, instead of owning the utilities, the municipalities have given away for nothing a perpetual franchise. Two noteworthy exceptions are Guelph, in Ontario, which owns both steam and electric railways, as well as the lighting plant; and Westmount, in Quebec, which has the first plant in America that develops municipal light from the incinerations of its refuse, and supplies its citizens at about half the rate they have been paying.

In the West, municipal ownership is more common, and the newer towns are benefitting by the bitter experience of their older sisters. Port Arthur and Fort William, which though in Ontario, are really in the west of Canada, are well known examples of enterprising and successful municipal ownership; they own their electric light plant, waterworks, street railway and telephone system, and are not only giving good services at low rates, but are reducing the taxes by the profits from these enterprises. Neepawa, in Manitoba, has its own telephone system. Winnipeg is securing a supply of electric power to sell to manufacturers, and the very suggestion of such a thing has made the private corporation cut the price of electricity in half. Medicine Hat, in Alberta, controls the supply of natural gas, and retails it to factories at a very low figure, besides lighting the city for a trifle. Many other instances could be given of successfu municipal ownership in the West.

It is gratifying to be able to say that a spirit of municipal progress is very evident in Canada. The people are realizing more and more that municipal government and ownership require clever and honorable men in the council; that public utilities are valuable; and that private ownership of public utilities—if permitted at all— must be under proper control, and shall yield some appreciable revenue to the citizens who give the franchises and whose money supports them.

It is still more pleasant to note that the thoughtful citizens are awaking to the needs of the city beyond the absolute necessities. The

need of more healthy surroundings for the homes of the toilers; of parks and open spaces as a necessity of public health; of playgrounds where the children of the poor can grow into vigorous men and women; of libraries and museums, of picture galleries and concert halls, where mental growth may take place of vulgar and indecent amusements;—in short, of those things which make for the advancement of mankind.

THE PRESIDENT: The paper is open for discussion.

MR. REIMER: There is one question I would like to ask. There was one sentence in that paper which referred to perpetual franchises. I heard it stated at the League of American Municipalities at Chicago, that such a thing could not be, and it might be possibly a matter worthy of discussion to be considered whether a franchise so called, which had been given apparently so that it would be in perpetuity, was a franchise which could be held in perpetuity or whether it was something which nobody had a right, or government had a right to give. It may not be germane to the subject, but it occurred to me the moment I heard that expression.

MR. CHRISTY: Mr. President, that may be a question I heard brought up in our section, and the lawyers all agreed that under our liberal league corporation law, that a charter once given is pretty sacred. The public corporations that have been chartered in Delaware to do public business in Delaware, have gone into business, and there have been times, and occasions came up that the authorities have seen that they would like to curtail or add to some of the conditions of their charters, and they have found by resorting to courts that they could do absolutely nothing. The matter was brought up forcibly when a company that was buying up a gas franchise and the people wanted competition in gas. I think this will get near the question you asked in your paper. The authority that had the granting of the franchise wanted to be assured that the company meant business. There seemed to be one way and that was to pay a lump sum to the city, they seemed to think that would assure the company going into operation. That was argued back and forth and they came to the conclusion that as far as that was concerned, that the old company would have to pay just that much more to buy up a new company. They then turned their

thought to putting something in the franchise that would forbid the company selling out to any other corporation, and they found that under the charter, which they were working, that you could add nothing in that line that would hurt the sale of the stock or bonds that they were allowed to put out. That when that company in good faith took a charter under the laws that the legislature set forth, that there was absolutely no way of curtailing any of the conditions. The law there on corporations is pretty liberal, and when they came to the municipal corporations they tack on a great many conditions until it gets to the question of tax, and the state laws state particularly what they shall pay the state for that charter. There is absolutely nothing that you can add to it that will put them in shape to keep them from being a menace to the old company. The nearest they could get to it was by saying, when upon the payment of a certain portion of their gross receipts they would go into business, but that was no assurance that they would ever go into business. We had a case of a gas company, under their charter they were required to reduce the price of gas when their receipts got to a certain amount; a new company came along and got a franchise, and laid about 300 feet of pipe and sold out to the old company. There were some conditions in the new company that the old company wanted. A plant, estimated to be worth not over a million dollars was immediately made two and a half millions. Of course the conditions in the first company's charter, in reference to the price of gas was put off about one and a half million dollars further. As far as I can see, we are still at the mercy of the corporations. We have to depend a good deal on the good faith of the people, and I am frankly of the opinion that is a bad plank to stand on, by what I have seen.

MR. WEISSLEDER: Since the paper read refers to franchises, both as to gas, electric and telephones, I think it is proper for me to make a few remarks, and I state if a corporation receives a proper grant, and is meeting all its obligations properly in every possible way, is it right for a foreign compnay to come in and be supported by a press? The people will suffer in every instance.

What is to hinder them from purchasing the stock? I just wanted to have this convention hear me defend the honorable action on the part of a corporation. I don't mean that a corporation in default and in every way amenable to the laws, I say then the corporation ought to be made to suffer for its misdeeds.

MR. RUST: In that paper of Mr. Bragg's, I was going to elaborate a little more on the situation in Toronto. The gas company and electric light compnay and Bell Telephone Company have practically a perpetual franchise as far as the dominion is concerned, and when we wished some time ago to buy out the electric light compnay they went to the legislature. Instead of buying them out we wished to start a municipal plant, they went to the legislature and got an act passed compelling the city to buy them out. We could not start a plant of our own without purchasing their plant. The gas companies are limited to a ten per cent dividend for their stock, and if they earn more than that they have to reduce the price of gas. They have reduced the price of gas, it is down to 80 cents now. The Toronto Railway Company only had a twenty year franchise, and fifteen of that is passed, and when we sold the franchise, we thought we had a very good agreement, but that agreement has caused more law suits than anything else. We get a revenue of nearly $400,000 a year, but we are continually fighting them. It is difficult to get them to live up to the terms of the agreement. It is a rather peculiar agreement in as much as the city engineer has to make the time table for them, he has to approve of the style of cars, and no extensions can be made unless the city enginneer recommends them, and there are several other similar clauses that throws the whole thing upon the engineer, which makes it very awkward for him. We had a contract with the Bell Telephone Company some years ago, in which they paid the city five per cent., but when the aggreement expired, the Bell Company refused to extend it, and since then we have derived no revenue from the company.

A MEMBER: Five per cent. of what?

MR. RUST: Five per cent. of the gross receipts. The receipts now are over two million dollars. The Bell people have the power

under the dominion act to erect poles on any street or highway in the dominion, but in municipalities the engineer has to locate the the poles. That is the only advantage we have. So far we have got along very well with the Bell Telephone Company. They have done everything we asked them to do, removed poles when we requested them to do so, and in other ways have lived up to the franchise that the dominion granted to them. The gas company has been very reasonable, but the Toronto Railway Company is a continual source of annoyance to us.

MR. WEISSLEDER: Speaking about revenues, the Cincinnati Gas & Electric Company pays half of one per cent. of its gross receipts and the Traction Company pays six per cent. of its gross receipts, and it amounts to a good deal. The State of Ohio does not limit the Gas Company, but there is a provision that the city may purchase their works on appraised valuation; but as long as the city does not elect to exercise its privileges, the franchise continues. The existing act was an act passed in the early 90's, permitting gas companies to engage as an electric light company and there is no limitation to time in that case.

THE PRESIDENT: The question is in process of settlement at the present time: I notice the large amount of change in public sentiment on the subject of perpetual franchises, and the courts seem to follow pretty closely the general sentiment of the country. There is a difference between the charter of the company and the contract of the company with the city, and in Indianapolis they have made a good deal out of that difference, and where it is not possible to handle the contract with the city, they have secured what they wanted by calling in the police powers, and in some cases it has been decided practical to make a franchise limited instead of perpetual in that way; that is, where it could be done directly, the condition which has brought about by the application of police powers in the city, that the company was glad to make contracts which would do away with the perpetual part of their franchise; that is, the part of the franchise which depends on the municipality itself. Of course, the municipality cannot interfere with the part

that derives its authority direct from the state. We will have to wait some time before we can have that question answered by the lawyers. This is the last paper for the evening. Mr. Davidson's paper is not ready, and Professor Folwell is absent. Mr. Chester's paper is postponed until tomorrow night, so that we can use the stereopticon. There is one other thing on the program this evening, and that is the appointment of the Committee on Nominations and Place of Meeting. I believe it is customary to elect those committees by the Association, and nominations for the Committee on Nominations are now in order.

The following gentlemen were proposed and appointed as members of the Nominating Committee: Messrs. Julian Kendrick, A. F. Eggers, C. H. Rust, Fred Giddings and T. C. Hatton.

MR. WEISSLEDER: I move that the nominations be closed, and that the Secretary cast the vote of the Association.

THE PRESIDENT: The motion is made that the Secretary cast the vote of the Society for the five named. Seconded and carried.

THE SECRETARY: The vote is cast.

THE PRESIDENT: The next is the nomination of the Committee on the Place of Meeting.

MR. WEISSLEDER: I move that the Presidnet be made a member of that committee.

The following gentlemen were proposed and nominated as members of the Committee on Place of Meeting: Messrs. M. R. Sherrerd, Geo. W. Tillson, Chas. C. Brown, W. H. V. Reimer, William H. Floyd, Jr.

THE PRESIDENT: Any further nominations? If not, a motion to elect these will be in order.

MR. WEISSLEDER: I move that the Secretary be empowered to cast the vote of the Society.

THE PRESIDENT: The motion is made that the Secretary cast the vote of the Society for the five names. Seconded and carried.

THE SECRETARY: The vote is cast.

THE PRESIDENT: The committee is selected. I wanted to announce again that Mr. Bowron will give us a talk on the trip we will take, and we will leave in carriages promptly at ten o'clock, and remember, on Thursday, the schedule we must travel on. We leave the Union Depot promptly at ten o'clock.

MR. REIMER: Is it fair to ask if the schedule will be like that we have been traveling on coming down here?

THE PRESIDENT: The railroad is a freight road, and they have stopped business for us, consequently we must be on time. We adjourn then until 9:30 tomorrow morning.

9:30 A. M., OCTOBER 10, 1906.

THE PRESIDENT: Now, gentlemen, it is about time for us to go, and we want to get some explanation of the district we are going over today and tomorrow before we start; and while we are not all in yet, I think it would be well for us to begin the proceedings.

We have with us this morning Mr. James Bowron, who knows the district by heart; he is one of the men who helped develop it, and he can tell us all there is about it, and I have asked him to talk to us as long as he can possibly find time, because I am sure every minute he puts in will be of value to us. Mr. Kendrick is getting the carriages for us and when they are ready for us to go, we will pull ourselves away from Mr. Bowron.

MR. BOWRON: It is always, gentlemen, a pleasure to man to speak to an audience that can think, an audience of men accustomed to listen to facts and to analyzing and appreciating them.

There is a great deal more to be said about Birmingham than is possible to say in thirty or forty minutes, as I am sure you will believe. Many cities of this country are well advertised, for Americans are not prone, as a rule, to hide their lights under a bushel, and he always puts his best foot foremost in speaking for his own city. Birmingham has spoken well for itself, and others speaking for us also, and I don't suppose any city in the country is any bet-

ter advertised than the City of Birmingham and surrounding district. The reason for that is not far to seek. Other cities are noted for their specialties. If a man wants a locomotive, he goes to Philadelphia, where the great Baldwin works are located; as a rule if he wants beer he goes to Milwaukee; if he was looking for investments in canned meats, he would go to Chicago; if he wanted to buy sugar, he would go to New Orleans; but the existence of the combinations of capital and currents of trade might cause the packing houses or refineries to be turned down; the locomotive works to be moved nearer to the materials and from this the cities of these industrial products would become changed; that, gentlemen, is not the case as to Birmingham. This city is great, is prosperous today, and potentially great in the future, because it is now, and so far as human knowledge and foresight can see, it will continue to be indefinitely fixed by nature, as the city of the cheapest manufacture in the world of one of the world's greatest staples, the article of pig iron. (Applause.) That, gentlemen, is not due to anything that we who live here have done, or to anything that we can do. We may bring together some degree of skill and experience, some amount of capital. Many of the districts in the world can bring together more skill than we have today, and much more capital, but they have not, and cannot get what we have got here, something that the Lord did for the Birmingham district, and that man can never duplicate. (Applause.) That, gentlemen, is such a remarkable proposition that when I draw your attention to it, that an audience of municipal engineers, of men, accustomed, I say, to think and analyze, can see that what I say cannot be regarded as controversial, but a simple statement of existing facts. Let me state for a moment that the State of Alabama is fourth in the production of pig iron; it is exceeded by the States of Pennsylvania, Ohio, and Illinois, in the order named, but the State of Alabama produces more iron ore than those three states combined. You catch the significance of that? The significance is that they have not got the material with which to run their furnaces, and they have to bring it from the great States of Minnesota and Michigan. Look at the production of iron ore, Ala-

bama stands third in the tonnage of production of iron ore; Minnesota and Michigan exceed it, but Alabama produces more pig iron by far than the States of Minnesota and Michigan combined. Why? Because they have to import the fuel, if you please, if they want to make iron out of the ore, which they dig out from underneath their feet, and we have them both together. Mr. J. M. Swank, the President of the American Iron and Steel Association, who has most honorably and ably filled that position, and now Vice-President-Secretary—I got so accustomed to calling him Secretary—who has so honorably filled the position at the head of the statistical department of the Steel and Iron Association for thirty years, has calculated that the average ton mileage involved in the production of pig iron in either the Pittsburg, Cleveland or Chicago districts is from 700 to 750; in other words, the production of a ton of pig iron in either the Pittsburg, Cleveland or Chicago districts involves the payment of freight on one ton of material for 750 miles, or the equivalent of more tons in a shorter number of miles. Right here, gentlemen, you can see today and tomorrow, you can get a birds-eye view today when you cross Red Mountain on your way to the waterworks, and tomorrow you will see from the train as you go around and visit the works, you will see places where pig iron can be made with a ton mileage of not exceeding six, and ranging from that to 25. You will go to Bessemer, so ably represented by my friend, Major Parkes, although he is not there now; still he knows it by heart and will tell you about it when he gets there tomorrow. There you can stand on a hill and throw a rock from the hill at the chute of the ore mines and turn around and throw a rock in the other direction and you hit the blast furnaces. I may point out to you, if I have the permission, as Mr. Kendrick suggested that I accompany you on your train tomorrow, I may have the pleasure of showing you at Ensley the point where within rifle shot of the iron ore (modern rifles, you will remember, will carry five of six miles) not more than five miles in a straight line, although about 15 as the railroads haul it, that absolutely in building coke ovens, we had to take away the coal at the outcrop to lay the foundation for the ovens. There you may stand on the blast furnace and take

a six-barrel revolver and you may fire a shot into the mouth of the coal mine, another in the coke ovens, a third in the casting plant where the iron is converted into blocks for the steel works, a fourth one you may fire into the blooming mill of the steel works, a fifth one into the rod mill where the billets delivered from the steel works, delivered red hot and run out into wire rods, the sixth one into wire plant, where the material is never cooled from the moment it comes out of the blast furnace till it comes to an end in woven fence wire. (Applause.) Now, gentlemen, why is this thus, just the simplest possible explanation. In most parts of the country and world we find that the iron ores or especially the sedimentary ores are necessarily of great depth. The igneous ores, which, of course, project, intrude, or extrude, I might better say, and will sometimes drive themselves up, are not to be found here. Why? This is not an igneous ore district. We don't find anything of that sort nearer than small ledges of them cropping up in the Cranberry Mountains of North Carolina, a sort of subsidiary or lateral range to the great Apalachian range. The great iron ore of this district is what is known as the red fossil; it is a metamorphosed limestone of the lower liberian measures and most persistent along the whole Apalachian chain, coming down the entire way from Pennsylvania right down to where we are here in middle Alabama, and of course in most of the intervening country, say, in Kentucky and in the northern part of Tennessee this ore is perhaps from one mile to two miles below the surface of the ground.

When going, say, from Cincinnati to Chattanooga, down the Queen and Crescent System, you are running over that ore all the way, but it is so deep below your feet that it is impossible, economically to mine it and bring it to the surface, but coming to this district, what do you find? Suppose my three fingers represent the bottom finger the lower silurian, carrying the red iron ore; the middle finger the sub-carboniferous rocks embracing the limestone, the upper part carrying the carboniferous measures, and this carrying the coal. Now take, if you please, one of these great upheavals pushing up from below, splitting gradually open, so then what have we got? You have got a great crack in the middle, when

the water runs down and washes out a valley and cuts it down and leaves the outcrops of iron ore, limestone and coal on either side standing up protected by the iron ore which you see is the inside one, protected by that from the eroding cutting effect of the rains until you have a long range of hills on either side and a great indefinite valley between them suitable for a river to run down, for a canal to be made, railways to be run, and for the location of blast furnaces, mills, steel works and foundries. There is the genesis of the district, the centralization of the natural material, the bringing together by the great upheaval forces of nature of the iron ore from two miles below until it is thrown right up within range and grasp of the same men working for coal and limestone, bringing it right together until you can take you hat and cover the whole thing, and you have got it in a nutshell. (Applause.) No carrying ore from the length of Lake Superior, the length of Lake Huron and the length of Lake Erie, and then carrying it 130 to 150 miles by rail to the blast furnaces at Pittsburg; no carrying of coal from the Connellsville field to meet the ore at Buffalo, Cleveland or Chicago. It is a strange thing, but true, that notwithstanding the wonderful cheapness with which materials are handled by railroads in this state, railroad freight does cut the biggest kind of a figure in the success of a plant according to its location.

My native country, and that part of the country which until the discovery and exploitation of this district, produced the cheapest iron in the world, the Tees district, with Durham coke on one side of the Cleveland or North Yorkshire iron ore on the other. In a little district, twenty-five miles long by one and a half miles wide, I could have shown you in that "banana peel," so to speak, about 160 blast furnaces and more than thirty rolling mills; a half dozen steel works, at the time I left there at thirty years of age and came to cast my fortunes with the South, and I am glad to say that the only regret I have after thirty years of experience as a northern man and an Englishman, living in the South, is that I did not come thirty years sooner. (Applause.) For the southern people are a warm-hearted people, and as they say, their latch

string hangs on the outside and while a great many of them who "fought, bled, and died" for the Confederacy, still hold as they have a right to hold after their sufferings and their troubles, strictly to their own opinions, I, as an outspoken republican, never in thirty years had an unkind word with any man in the South, because of my politics. (Applause.) People here, when a man comes don't say who is that man's grandfather; what is his family; what is his politics? They say he has come, has he; what does he do? A man's position in society in Birmingham is gauged by what he does to make himself useful to the body politic, and that is why we, with this degree of energy are envied by some of our western brethern; that is why this southern city, this cosmopolitan city, in the South has grown from the point of, let me see—say, thirty-five years ago, it was that Major Milner and others pulled the first house up, as he told me, with the assistance of a mule and block and tackle, he standing by the first frame shanty. About thirty-five years ago that was done, and today we have a street car population of 150,000 people. According to Mr. Babb, Secretary of the Commercial Club, within the last year 12,000 people have been added to the population of Birmingham district, 2,400 houses constructed and that $22,000,000 has been permanently invested or the expenditure of that amount projected within the past fiscal year of the Commercial Club. So it is that we have only really "struck our gait," if it is permissable to introduce a baseball term in an august assembly of this kind. For a number of years people scoffed at the production of pig iron in the South. One of the first things I heard when I came to live in the South and help open coal mines and build furnaces was, "Well, they do make some pig iron in the South, but I will tell you what they ought to with it. They ought to divide it up into specimens and take it to the different museums of the country and put a glass case over each piece, and label in front 'tread softly, very fragile'" (laughter). Well, gentlemen, a child has got to crawl before it can walk, and walk before it can run, and no doubt they did make some pretty fragile pig iron with 1½ per cent. phosphorus. This was rather up in the Tennessee district, where they began operations earlier

than we did here. The iron ore here naturally runs about 85-100 of one per cent. of phosphorus. It is a fact that the first steel rails I ever saw in the South, which were made in Chattanooga, were so high in phosphorus that when they were unloaded they were thrown off the car and several of them broke in pieces in throwing off. Well, everebody has got to wrestle with these things, and by degress we found out we had got some ores not so phosphorous as others; although the red ore contains a great deal of it. We have numerous deposits scattered in the district of brown ores which have leached from the original carbonates and have become crystallyzed into limonites or brown hematite ores with fifty per cent. iron and not containing more than four-tenths of one per cent. phosphorus. These ores are not very greatly used, but lie in pockets instead of the stratified beds and being of quite indefinite volume, are more desirably used as a mixture with red fossil ore, to which I have previously referred. In that way we began to make iron that was not so high in phosphorus, and pushed it a little in other districts, and when we first went in some other districts people laughed at us. I remember in 1879, going to St. Louis, to introduce the iron of the company by which I was employed, and the gentlemen in St. Louis laughed at me and said "My young friend, we would not think of using any iron in our mixture but the great Scotch iron and at least No. 2 Hanging Rock from Ohio." Well, I have lived long enough to send Birmingham pig iron into Glasgow and to send it to Hanging Rock, Ohio, and have sold pig iron for my employers, The Tennessee Coal, Iron & Railroad Company, and shipped it to England, Scotland, Ireland, Holland, France, Belgium, Russia, Germany, Austria, Spain, Italy, Greece, Egypt, India, Burmah, China, South Africa, Australia, and Japan. (Applause.) Think of it, gentlemen, that we should have to make pig iron here, in Birmingham, in an inland city, and send it 258 miles by rail to the nearest shipping point upon the sea, and still compete with cities that are located upon the tide water! What a wonderful testimonial that is to the ability to make pig iron cheaply here.

I have heard it said that no great city can exist which is not located upon navigable water. That statement has become almost

proverbial because in the very nature of things in a country so fast as the United States in the growth of our population and development of the country our cities have been compelled to be located originally where men could get about either by sea or by river or by lake, because this country was settled before the initiation of railroads, and men could not get about any other way, but how idle is it to suppose a great city cannot exist without navigable water. Let me point a moment to England, and such great iron cities as Birmingham, Sheffield, Leeds and Wolverhampton. By crossing over the continent, you find great national capitals as Berlin, and Dresden, each of which is on a river, but neither river navigable and which is served by canals; Madrid, Milan and the great manufacturing cities in Russia—Kiev and Moscow. It is out of the question to insist that a city cannot exist without navigation, but let me tell you something, this city, such as it is, is going to have navigation. The United States Government, slowly and by piecemeal is very laboriously one step at a time, one lock after the other, giving us navigation on the Warrior River, and we have today a navigable water, I believe, touching the extreme southwest corner of Jefferson County, in which we are now sitting, and in the course of three or four years we will bring the navigable water up to a point where the Secretary of War has recommended to congress as feasible and suitable the project of the canalization of Valley Creek up to Bessemer, and Village Creek up to North Birmingham. The time will come within the lifetime of many of those here present, when the manufacturers of Birmingham instead of paying a toll of $1.00 on pig iron for export or $1.00 on coal for export will send it by barge down the river according to the estimate of the Secretary of War for twenty-five cents a ton, and with the opening of the Isthmian canal will absolutely command the world's trade on pig iron and coal upon the Western Coast of the North American Continent. These, gentlemen, are not idle dreams, some of us know what we are talking about. Railroads make exceedingly good rates, make lower rates than could be given were it not for the fact, as I said, we are 258 miles from the gulf, but we are at the Union depot here in Birmingham, 602 feet above

the sea level, therefore, you see that gives two feet and two inches to the mile in favor of the loaded cars going with our iron and coal down to Pensacola or Mobile; and that is why they can make exceedingly low rates. I want to say further that the great railroad systems, prominently the L. & N., Queen and Crescent and the Southern Railway, have worked manifestly for the upbuilding and development of this district. They have handled the raw material at prices that absolutely left them no profit. They handled the whole thing by zones and they bring in from a zone of a certain number of miles the ore, coal and coke for the furnaces, and the pig iron for the rolling mills at 12½ cents per ton. They have treated the district with extreme liberality, realizing that by so doing they would build up a large city with enormous shipments of finished products, which would pay them profitable rates and develop a great populous district where the movement of passenger traffic and miscellaneous freight give them splendid revenue. Today I insist that as chickens come home to roost, the great success of the Louisville and Nashville Railroad, the splendid revenue it is earning, that 7 per cent. of its stock today is due to the foresight and energy of one Milton H. Smith. Twenty-five years ago, when this district was in its infancy, he ran his tracks into every mine he could get to and other men have come since and done equally as well according to their capacity.

Now, I was saying that this district is still just striking its gait. I spoke of the poor quality of iron we made, but we pushed ourselves out, and the people began to say there is a little iron going to the East, but it does not amount to anything, it amuses them and don't hurt us; and by and by, a year or so later, they said a great deal of that stuff is coming up, but we know it is no account, and they have to sell it a dollar a ton below what anybody else gets for their iron. It don't pay and they will have to quit; and we kept pushing, and by and by they said these fellows are sending lots of stuff up here, surely they cannot get money anywhere else, and if you give them rope enough they will hang themselves, and it will be an end to it. We still kept on, and by and by they began to pay the same prices as they paid for their own iron. Well,

they said there is a market for a lot of this stuff, but we know it has not any strength in it and has a good deal of silica and makes sharp castings like architectural castings and stoves and radiators, and things of that sort, where you want to have your iron as fluent as water, but will never do for engines and strong castings, etc., and besides that it will never do for steel. Now, gentlemen, the growth of steel and the way steel has crowded iron out is one of the wonders of our age.

The strongest factor in convincing the directors of the Tennessee Coal, Iron and Railroad Co. that they would be compelled to go into the manufacture of steel in the South was a pamphlet I compiled, in which I showed year by year how the proportion of iron going into the steel was increasing, and the proportion of iron used as iron was decreasing. Do you know, last year there were 23,000,000 tons of pig iron made in this country, and nearly 20,000,000 tons of steel made. The whole 20,000,000 was not made out of pig iron, because a great deal of scrap iron went into the manufacture and certain portions of crushed ore, and it is not unreasonable to suppose out of the 20,000,000 of steel 19,000,000 tons of pig iron went into it, so that only left 4,000,000 tons to be used as iron, instead of being converted into steel. Now, thereon hangs the tale, and on that tale is the development of this district. Out of the 20,000,000 tons of steel made last year, 11,000,000 tons were Bessemer and 9,000,000 open hearth. Twenty years ago open hearth steel was not a curiosity, but a thing that was not looked upon as any very great improvement. All the rails of the country were made out of Bessemer steel, and practically everything else was made of Bessemer steel. They said we cannot afford to pay $1.50 or $2.00 per ton more for open hearth steel because in those days men made open hearth steel expensively in one ton and two-ton furnaces; then by degrees the genius of the American mechanic came along to the rescue, and instead of making open hearth steel in little furnaces, they begun to make it in thirty-ton furnaces and fifty-ton furnaces, and then the genius of another man came along, and he was an Englishman, too, and he worked side by side with me in the same employment. He worked at Chattanooga; he discovered

the method of Talbot process, and by the Talbot process, discovered at Chattanooga, instead of the mechanical mixture of solid iron ore containing oxide of iron to oxidize the metalloids in the pig iron, charge or oxidize the iron molten in a slag bath by pouring the iron from the cupola or ladle there is a condition of instantaneous molecular contact and the oxide cutting loose your metalloids from the molten pig iron, and the phosphorus cut loose from the iron catches to the lime of the slag and makes a phosphate of lime, which being stable enough not to go back into the iron below, you pour your slag off, and there you have your fifty tons of pure metal.

When you make Bessemer steel, and I have very little doubt that every gentleman in the room is familiar with the manufacture of Bessemer steel, you blow freely until the metalloids are oxidized and decide by the spectroscope theoretically, but really by the eye of the men making the blow, and as soon as your smoke turns brown, the man says "We are beginning to burn iron, shut it off quick." Manifestly that is a rough and ready proposition and a question of 22, 23 or 24 minutes, so you cannot tell to 1-10 of one per cent. what you can take out or what you can leave in, and therefore you get a steel for making rails, boilers, etc., which may vary by a tenth of one per cent. in such elements as phosphorus, but you cannot get steel the same high quality that you can market it in an open hearth furnace. Where you dig a ladle in and bring out a sample and put that in water and break it to see its granulation, you note its appearance and judge by an experienced eye, and be absolutely sure that you put it through one of the modern processes and by centrifugal force, you find the degree of the purity of the metal and let it go on another twenty or thirty minutes, according to its necessity. The result of this is that today open hearth steel can be made at substantially the same price, at the same cost, or within fifty cents or so of the same cost of Bessemer steel, and you have a product which may be worth from $1.00 to $2.00 to $3.00 a ton more because of its greater purity, its greater ductility. When I talked with the director general of the Royal Swedish Railway System upon the quality of steel rails, I told him what has since come to pass, that the rails made there would by reason

of the process be of such high quality that they would be worth at least a dollar a ton more money, and he agreed that in the extreme arctic circle, they would be worth more, and he would be willing for the Swedish government to pay a dollar more for open hearth rails than for Bessemer. Now, begnning with making pig iron, which had to be put in a museum and labelled tread softly, for fear of breaking the specimens as you pass, you come today to the position where the man who makes stoves, radiators and architectural castings would rather have Birmingham iron than Scottish iron, because our iron runs as sharply and makes as clean and sharp a casting with as clean a face, and has not more than half the phosphorus in it, and not more than half the shrinkage. We have proved that we can make iron of low silicon quality. I have seen pig iron made right at the Alice Furnace down the street in the blast furnace containing .02 or 1-50th part of one per cent. of silicon made in a blast furnace, and iron practicaly as nice in the blast furnace as you get it in the old-time ordinary iron refinery. If we want to make a low silicon iron we can run on the hard red fossil ore, which contains its own lime, and which has a surplus of lime, so that every atom of silica in the ore is already mated to an atom of lime and goes off in the slag with it; we can make iron so low in silicon and tough that we can make car wheels right here in Birmingham, and do make them out of our own iron. Melt the old wheels over and bring them in as part of a mixture and add our iron. We can build Corliss engines with our own Birmingham iron. Go to the Hardie Tynes plant and they are running on nothing else but Corliss engines, sending them to New York and Pennsylvania. Go to Dr. Boland's plant in East Birmingham, and you see numerous makes of machinery for the sugar mills in Louisiana and Cuba. The day is coming and not far off, when, with the opening of the Isthmian canal to the completion of which the energy of Hon. Theo. Roosevelt and the power and financial ability of the United States Government is pledged, we will have in the Gulf of Mexico a harbor of safety where the steamers are going to save from four to six thousand miles by going through the isthmus instead of going around Cape Horn; when the steamers from London,

Liverpool and Hamburg will find their quickest route to Japan, China and Australia by going through the isthmus instead of going around Cape Horn, we will find great harbors made which nature has already largely provided for, in the great harbor of Mobile bay, with its twenty-six foot channel and the area of forty foot deep water inside of that great sand bar that protects it from the outer surf. In the great Bay of Pensacola we have a great natural harbor, there gentlemen, many of you are going to see the day when the great steamers will be constructed at Mobile out of plates rolled forty feet long and one and a half inches thick and eight to twelve feet wide, which will be rolled at Ensley, Birmingham, Bessemer or North or East Birmingham, with equal facilities out of the open hearth steel made here in Greater Birmingham, which will be barged down our canal down the open Warrior River, and will be followed by barges of coal, which today, after paying 267 miles of railroad freight, we put on board ship in Mobile and Pensacola. I, coming from the English North Country coal mining regions, and having been in business there, know what I am talking about, and I say this coal can be put on board ship on the gulf coast $1.00 for $1.00 and ton for ton the same price that coal can be shipped after hauling it ten, twelve or fifteen miles by railroad to Sunderland and Newcastle, that being so the English steamers will carry all the freight they can carry; they will not load up with bunker coal in England, but will utilize all the space they can. They will will put in between trips at our Southern ports, and the whole tendency of the growth of the Western coast of the American Continent will be towards the upbuilding of this favored section; favored by the river navigation and open harbors on the coast, which are now being developed, favored by the capital and energy of a cosmopolitan people, Americans from the East and West, Canadians from the North, Englishmen and Germans and others coming here as they are going to other points of the country, favored by a benignant climate, where we are never troubled with the ore being frozen in the bins, where we never have our coke frozen in the cars; where we do not suffer by our tuyeres and water jacketing being burst over night by the frost, as so many of our friends in

the North have to combat and struggle against; favored by a climate that permits the houses to be built of cheap construction, by a climate that inflicts upon our labors the smallest possible charges for clothing to resist the cold, and which permits the people to live largely upon a vegetable diet, raised in truck farms surrounding their cottages, if they will, without the expenditure being made for food which is required on the part of those living in cold climates; favored by a climate where work is not suspended even in the hottest part of the year by reasons of the heat; for while we have a more protracted heated term than our friends up North, it is not so severe, and our heat is a dry heat, and our nights are cool. In this favored valley where we live, the great mass of heated air rises during the day, and clear breezes from the gulf, push and sweep their way to us in the evening, so that by half past ten almost every night in Birmingham the leaves of the trees begin to rustle, and the evening breeze coming from the gulf through great pine forests casts its soft and balmy resonance upon our skins so that our nights are always delightful. With the warm hearts of the people, always extending a welcome to those who come and mix with us; with a diversity of our industries, iron, steel and coal filling prominent positions, closely followed with the great diversity of collateral and subsidiary forms, cotton following in their wake, rolling stock, room for the construction of locomotives and cars and track material, room for practically everything that can be produced from steel, iron and lumber and textiles or that can be produced from cotton. Oh! how great the future, man may make here, when American energy, American skill and money shall be placed and combined with that which the Lord has already done for us. (Applause.)

THE PRESIDENT: I am sure I voice the sentiment of the Association when I thank Mr. Bowron for his address. The time for our trip has come, and you will find the carriages at the foot of the steps and Mr. Kendrick will be there to locate us.

MR. RUST: I have listened with a great deal of interest to the able address delivered by Mr. Bowron, and I wish to move a vote

of thanks of the Society for his delivery of the magnificent speech. I, coming as I do, from the North, must say I am very much pleased and interested in the address of Mr. Bowron, and I am sure most of us are very much pleased with the speech.

THE PRESIDENT: Those in favor of this motion will please rise. (The motion was unanimously carried.)

Adjourned until 8:00 P. M. October 10.

8:00 P. M. OCTOBER 10, 1906.

THE PRESIDENT: Gentlemen, you will please come to order. We have a pretty full program for tonight, and it will be necessary for us to begin it. Before the program begins, I wish to appoint a committee which has been neglected heretofore, and that's a Committee on Resolutions, which will be expected to report on Friday.

THE PRESIDENT: We have the pleasure tonight first of listening to a paper by Mr. Geo. G. Earle, which will tell us of the good work that is being done in New Orleans on the new water works and sewerage of that city:

PAPER ON THE NEW ORLEANS WATER WORKS, ILLUSTRATED WITH THE STEREOPTICON.

BY GEO. G. EARLE, GENERAL SUPERINTENDENT SEWERAGE AND WATER BOARD, NEW ORLEANS, LA.

Preliminary to description of the water works of New Orleans, now under construction, it will be best to introduce to your attention something of the general conditions which have surrounded, and in a large measure controlled, the development of the local situation to the present time.

New Orleans was founded in 1718, and under French government until 1769, from which date, until 1803, she was under Spanish control. In 1803 after the Louisiana purchase she passed into the hands of the United States with a population, largely of mixed French and Spanish origin.

Located at the ocean gateway of one of the greatest systems of navigable waterways in the world, when heavy transportation was compelled to move almost entirely by water, New Orleans became at once a city of destiny, and despite natural obstacles, she was in 1800 the fifth city in the United States in population.

In 1800 to 1830 the rate of growth of New Orleans paralleled the growth of Boston, Baltimore and Philadelphia, reaching a population of 46,000 despite an average death rate of over 42 per 1,000, brought about by unsanitary conditions, and particularly by frequent visitations of yellow fever, introduced by commercial intercourse with tropical countries of the South.

From 1830 to 1840 New Orleans more than doubled her population, passing the 100,000 mark, and reaching the position of the fourth city of the United States in population, only New York, Philadelphia and Boston had a greater population. and the two last named had but a few thousand in advance. The growth in population came notwithstanding an annual average death rate of nearly 60 per 1,000. During the decade severe yellow fever epidemics were of frequent recurrence, and for two years cholera raged with a death rate in the worst year, which removed nearly one-sixth of the total population.

That the city doubled in population under these conditions speaks volumes for the logic of her location.

After 1840 the logic of location gave way to the more inexorable logic of death, and the growth of New Orleans as compared with other cities showed favorably only in the cemeteries. From 1840 to 1860 the death rate averaged about 58 per 1,000 of population—far more than double that of other cities.

The war brought an embargo of commerce from Southern ports, and a general cleaning up, with some crude efforts towards drainage, which reduced the death rate from the decade 1860 to 1870 to about 40 per 1,000, despite a terrible yellow fever epidemic, which followed the renewal of commerce in 1867.

In 1873, and again in 1878, frightful epidemics of yellow fever were experienced, but the average death rate for the decade was cut down to something like 32 per 1,000.

After the experience of 1878 the State Board of Health was reorganized, and an efficient quarantine was established at the mouth of the river, which prevented the introduction of yellow fever in the decade 1890 to 1900, and the death rate was reduced to the average of 28.5 per 1,000.

From 1890 to 1900 conditions affecting the health of the city remained substantially as in the preceding decade, except that yellow fever found entrance through another port and reached New Orleans by infection brought from this point in 1897, and was present in the city in decreasing amounts in 1897, 1898 and 1899. These visitations of fever were not severe, and had comparatively small effect upon the death rate, which averaged about 27 for the decade, standing at that figure for the last two years thereof.

In 1900 New Orleans had a population of 287,000 and stood the thirteenth city in the United States in population. Her decline from the fourth place, which she occupied in 1840, may be charged partly to the fact

that railroads leading east destroyed the power of inland water transportation to command commerce, and partly to the retarding influences of the war, and of the era of the so-called reconstruction, when incompentent and corrupt rule plunged the city and state into a sea of debt, from which they are only now beginning to emerge. But the sanitary conditions of the city and the evil sanitary reputation, which lingered, even as the conditions began to improve, have been the chief causes of her failure to grow from within, and to attract growth from without.

If some power could have reduced the death rate of New Orleans to 20 per 1,000 in 1867, and maintained it at that rate, there is little doubt that she would have had a population of over 500,000 people in 1900.

The main cause which prevented sanitary improvements on an adequate scale was a conservatism, which pointed to natural difficulties, that were claimed to be insurmountable. A large element of the population really took a pride in saying that the city could not be sewered or drained, and that the waters of the Mississippi River could not be purified on a scale adequate for a public water supply. The result of this conservatism was that nothing was undertaken.

It is true that the conditions in every respect were most difficult. New Orleans is practically in the center of an alluvial plain, which has been built up by the deposit of the silt laden waters of the Mississippi River, which river has in recent geological times advanced a coast line 100 miles long, an average of about 80 miles into the gulf from the original gulf coast. This great alluvial plain lies at just about mean tide level, and is intersected by old river outlets, along each side of which a narrow strip of land has been raised by the heavier deposits of the overflows to a few feet above the tide level, sloping gradually back to the tide level, swamps, lakes and bayous in the rear. Through accretions of fine silt, and through the growth and decay of vegetables, with a gradual subsidence of the accumulated mass, a new land was being slowly created by the force of nature. Its fertility was a temptation not to be resisted, however, and very early in the history of the country, every available elevation capable of cultivation was taken possession of. Gradually levees were constructed to prevent further overflow from the river, and thereby nature's process of gradual filling has been arrested.

New Orleans was located solely with a view of taking every advantage of the opportunities for navigation, which existed, from that standpoint, the location could not have been better chosen.

The city itself, or that part of it which is receiving any consideration in present development, covers an area of about thirty-three square miles, and could easily accommodate a population of 1,300,000 people. This area is bounded on the north by Lake Pontchartrain, and on the south by the Mississippi River and on the east and west by levees. (Incidentally, it should be said that there are levees between the city and its north and south boundaries also.)

The Mississippi River is about one-half mile wide, and from 90 to 180 feet deep at New Orleans. At low stages of its water, the river surface rises and falls with the gulf tide, and despite the fact that its minimum discharge is 200,000 cubic feet per second, and its distance from the gulf 100 miles, we often find its surface at New Orleans practically at gulf level. At high water the river surface is nearly twenty feet above the gulf level, and its discharge something like 2,000,000 cubic feet per second, and every foot of natural ground in the city except the levee tops is from six to twenty feet below the water level of its seething yellow waters.

Lake Pontchartrain, the northern boundary of the city, is really a shallow arm of the Gulf of Mexico, slightly brackish and effected by the gulf tides, which have a daily fluctuation of only a few inches, but which depend upon the influence of the winds and have an extreme range of over six feet, from more than four feet above to nearly two feet below mean gulf level. The thirty-three square miles of area of the city, with reference to mean levels lie as follows: Seventeen square miles at from two feet below lake level to lake level; seven square miles at an elevation between high and mean lake levels, and nine square miles from high lake level to ten feet above said level, but still from five to fourteen feet below the level of high water in the Mississippi River.

The natural soil is practically all an alluvial deposit or a product of such deposit in vegetation more or less decayed. Irregular strata of sand from fine to coarse, and clay from very soft to reasonably firm, and mixtures thereof, roots and peaty strata, with cypress stumps and logs from forests of other days, some decayed and some very well preserved, all go to make up a soil condition, which for underground constructions or for foundations present an average of cost and difficulty not often encountered.

The bearing of the above outlined conditions upon needed sanitary improvements at New Orleans, especially upon sewerage, water works and drainage, is obvious, particularly as one board is charged with the three works, with a common fund, so that the development of either is necessarily to a degree dependent upon the other two.

In 1892, when the writer first located in New Orleans, the city had no sewerage system and no underground or deep drainage, the then existing drainage being only a matter of surface gutters leading into open canals, in which the water always stood within two or three feet of the ground level, which was overflowed for hours and, in parts, sometimes for days after every considerable rain.

Of the 60,000 premises then existing each had a hole in the ground to receive fecal matter; each discharged its liquid wastes into the open street gutters, and each depended for its clear water supply, and usually for its whole water supply, upon cisterns, i. e., cypress tanks built above ground and precariously supplied with rain water from the roof of the premises served. About one-tenth of these 60,000 premises had also a

connection with the mains of the New Orleans Water Works Company, which only covered about 100 out of 350 miles of built up streets and supplied Mississippi River water (and mud) to its consumers. This water, filtered through stone filters, was and is a magnificent water, but in its natural state, as drawn from the mains, is really unfit for practically any use.

The New Orleans water works system, as now existing, dates back to 1836, when a private company with a franchise, started its construction and gradually extended it until in 1868 it covered about 65 miles of streets—at this date it was purchased by the city. Private ownership had been bad, but in this case public ownership proved worse, and in 1878 the city sold to another private company, organized under a state charter, retaining this time about one-fifth interest in the property. Both transactions were largely paper transactions in depreciated securities.

The new company made considerable extensions, bonding the plant to cover their cost, and by rather high rates and the application of earnings strictly to dividends, paid five to six per cent. dividends on the $2,000,000 of capital stock, besides paying interest on some $700,000 or more of bonded indebtedness. This brought the stock to par, or above, and with a franchise extending for something like thirty years, the present earning capacity and possibility for future extension and increased earning capacity outweighed the actual value of the plant, and the prospects of the water works company seemed very secure.

There was, however, among the people of the city, a strong feeling of dissatisfaction with both the service and the rates of the company and a desire to recover for the city both the sewerage and the water works franchises which had been given out, the former not having been carried out to even such an extent as to render *any* service, and the latter not having been made to produce a service in any sense satisfactory. As a result litigation looking to the forefeiture of both franchises was started.

In the case of the sewerage franchise this litigation was settled by the purchase of the constructed works at little more than the cost to duplicate them and their incorporation in the new system. No similar compromise being possible in the water works case, it was carried through to the United Supreme Court and resulted in the forefeiture of the company's charter on the ground that they were charging inequitable rates and rates in excess of their franchise rights. During this litigation the city had been making progress in the construction of a great drainage system, and had also framed and passed a law creating a Sewerage and Water Board and authorized a tax which amounted to .004 on the assessed valuation of the city to be levied until 1942 and to be expended either as interest on a $12,000,000 bond issue for (and any surplus to be used in the construction of) a sewerage, water and drainage system.

Under this law sewerage and water for sewerage uses and for public and charitable institutions is to be free, and paying consumers on the water works are to be charged only such rates as are necessary to pay

the cost of water works maintenance and operation; and it was further stipulated that not over one-third of the funds thus made available could be expended on drainage until sewerage and water works systems were completed over the entire populated area of the city.

Shortly after the creation of the Sewerage and Water Board, the operation of the drainage, and any further drainage construction, was placed wholly under their jurisdiction; so that the three works have received equal consideration at their hands.

The major part of the drainage construction done to date was executed before the existence of the Sewerage and Water Board, but they were required from their funds to take up outstanding drainage bonds and carry forward outstanding drainage contracts, all aggregating $3,900,000, and it was evident that the full one-third of the total funds permissible by the law would need to be used for drainage improvements.

The Sewerage and Water Board, therefore, undertook these three works with a limit as to resources, which proved very embarrassing when the lowest possible cost of the three improvements was calculated.

The problem present was how, out of a $12,000,000 bond issue, to build 400 miles of sewers and necessary pumping stations at an estimated cost of	$5,300,000
400 miles of water mains and pumping and purification plants at an estimated cost of	5,500,000
With connections to both systems to the property line, estimated to cost not less than	1,500,000
And take up outstanding drainage bonds and contracts, aggregating	3,900,000
Or a total of	$16,200,000

The solution of the problem, after careful study, was in the following form:

The fixed income of the board approximated a four-mill tax on the constantly increasing assessed valuation of taxable property. This income could be expended either as interest on outstanding bonds, or any surplus, after payment of interest, could be expended on construction. The $12.000,000 of bonds were sold to a syndicate at a price which netted the Sewerage and Water Board $12,550,000, but are only issued to them as the money is needed to carry on construction work. By fixing the rate of construction expenditures so as to complete both systems by the end of 1908, thus building part of the system out of the annual income, and arranging to make the greatest expenditures out of money from the bond issue in the latter part of such period of construction, it was shown that there would be a great saving of interest and a total sum available for expenditure on construction equal to the amount above named, and this policy was, therefore, adopted and publicly announced in 1901.

With time, however, it has been found necessary to extend and improve the drainage system to the full limit of expenditure legally available therefor, and the necessity to continue drainage improvements upon a much larger scale has resulted in legislative authorization to increase the bond issue by another $8,000,000, which further issue it is shown can easily be carried and liquidated before 1942 out of the tax already voted, still leaving a considerable annual surplus to be expended upon extensions of the three systems.

If this last issue is voted and placed New Orleans will obtain, as rapidly as the money can be judiciously expended, such improvements in drainage as will bring all three systems to a very high state of efficiency. The expenditure will stand something as follows:

Sewerage and connections	$6,500,000
Water works and connections	6,600,000
Drainage	10,900,000
Total	$24,000,000

Without the additional issue sewer and water works systems, exclusive of connections to the property line, will have been completed by about the end of 1908, and the drainage will have received such expenditures as were allowed under the law, and will be in condition to handle satisfactorily anything except the very greatest storms. Further extensions and improvements without the bond issue can only come gradually as the annually increasing surplus from the tax will pay for them. In 1909 there will be, for instance, a surplus of over $300,000, and by 1920, by most conservative calculation, this surplus should be over $600,000. In other words, it will take probably twenty years to bring the improvements which can be made in three or four years out of the $8,000,000 bond issue if such issue should not be made.

In establishing the basis of design for the Water and Sewerage Systems the factor of cost of operation had to be kept very clearly in view, and in order to expedite the real work a meeting of the Advisory Board of Engineers was called to review and authoritatively eliminate from further consideration so many of the numerous projects and suggestions, which are always urged when works of this character are contemplated, as evidence then available would warrant the elimination of.

Projects thus eliminated were numerous, including the further consideration of a local artesian water supply or of the bringing in of water from either artesian wells or from surface supplies of relatively clear waters available from water sheds of small rivers north of Lake Pontchartrain by a pipe line 40 miles or more in length, depending upon the locality chosen, it being conclusively proven that either of these projects would increase the cost both of construction and of operation greatly beyond the cost required for the purification and utilization of the Mississippi River, that such increased cost was beyond possible consideration

with the money in sight, and that these projects offered no advantage to make them worth further consideration.

These projects were quite widely favored, and there was a large element who doubted the possibility of adequately purifying the Mississippi River water upon a scale and at a cost which would make it available for a public water supply. The fact that one of the big filter companies had failed utterly to carry out their guarantee, or to anywhere nearly produce a satisfactory result in a filter plant erected for the New Orleans Water Works Company in 1892 and 1893, was used as an argument, and to those who had no knowledge of the advance made in water purification subsequent to 1893, this argument was quite convincing.

In order not only to show to the people of the city the entire practicability of the project proposed, but also to determine the various factors which should govern the design of a large plant, an appropriation of $25,000 was made for the construction and operation for a year of a small experimental plant to purify 100,000 gallons of water a day, with arrangements to try both slow sand filtration and so-called mechanical filtration. with various periods of plain subsidence and of coagulation; and with a laboratory force and equipment adequate to make chemical and bacteriological examinations of the water at every stage of purification.

This plant was established in a public park, and the public were invited to visit the station at any time and were shown as much of its workings as they cared to see. The moral effect of continuous streams of perfectly clear water during the entire time that this plant was in operation was alone worth its cost; and the practical data obtained bearing upon the proper design of a plant to meet local conditions was worth many times this cost. The results of the investigation were substantially as follows:

The Mississippi River water was found to show practically no evidence of pollution despite the immensity of its water-shed and the great amount of sewerage entering it and its tributaries. It contains, however, a very large amount of very finely divided clay particles and, at times, of very fine sand in suspension, ranging from about 200 to 1,500 parts per 1,000,000 of suspended matter, rendering it almost always very muddy in appearance. Freed of this suspended matter it is a colorless and perfectly clear water, unusually pure from a sanitary viewpoint, but containing in solution enough of the carbonates and sulphates of lime and magnesia to be called a moderately hard water—not nearly so hard, however, as very many waters used and highly esteemed as water supplies—and containing also considerable amounts of dissolved carbonic acid gas and oxygen.

The original investigation looked only to the removal of the suspended matter and was conducted with sulphate of alumina as a coagulant and proved that a period of 12 hours for plain subsidence, and an equal period of auxiliary subsidence, with coagulation followed by rapid filtra-

tion, was best adapted for the economical clarification of the river water. Often plain subsidence was of no effect, but when the water was very turbid a great deal of the coarser matter was eliminated by a short period of plain subsidence and the saving of coagulant warranted the 12 hour period of plain subsidence, as well as the unusually long (12 hour) period of auxiliary subsidence after coagulation. The average removal of suspended matter in 12 hours was about 35 per cent., but longer periods were of so little additional benefit as to be practically useless. Following this first investigation the laboratory, with a diminished force, has been retained continuously, and as a result of experience elsewhere, and further studies in New Orleans, it has been decided to go a step further and soften as well as clarify the river water. This decision has been reached because it was found that by the substitution of the lime and iron process a soft water could be obtained at practically the same first cost and cost per 1,000 gallons that would have resulted from the process first studied, and it was considered that with a population used to a perfectly soft cistern water there would naturally be some objection to even a moderately hard water.

Another matter requiring careful consideration was the question of per capita supply to be assumed in designing the system. The cost of chemicals for purification, the cost of cleaning out mud from reservoirs, the cost of pumping water two or three times before it reached the consumer, and the pumps and cost of the distribution system were the first factors to be set down in arriving at a conclusion in this matter, but they were not by any means the only ones, as having brought a clear water supply to 65,000 premises we must arrange to take it away again as it was fouled by the various uses to which it would be put, and the cost of sewers and pumps and pumping for all time to come for from one to three lifts before it was discharged again into the Mississippi River had also to be considered.

Weighing all of the above considerations the sewerage and water works systems were designed with a view of an average water consumption of 100 gallons per capita and a maximum hourly rate of consumption of 180 gallons per capita with liberal allowance for fire protection in the adjustment of the sizes of sub-mains on the waterworks system.

The site chosen for the water purification and pumping station is located at the extreme upper end of the city and about 4,000 feet from the intake. At this point an area of some 65 acres, covering some 26 city blocks, has been acquired at a cost of about $70,000, which area will be adequate for a city of 1,500,000 population. This location combines the following advantages: It is close enough to the river to permit of the placing of the low lift pumping machinery under the same roof with the distribution pumps, making only one mechanical plant for waterworks operation; it takes water from the river just as it reaches the upper end of the city, and is properly located for a purification plant if in the future for some reason it is desired to move the intake further up the

river, or even if it should be found eventually that water from north of Lake Pontchartrain possesses some advantage over Mississippi River water not now apparent. It is located so that the construction of a 4,000 foot switch track connects with the Illinois Central R. R. with the proposed City Belt line, and with a wharf located at the waterworks intake, so that coal, coagulant and other supplies can come by rail or by river and be economically handled from either point.

Again, this location permits of the present construction of a main supply line, large enough for present needs, which will reach the center of population of the city at the shortest possible distance and run through or just in the rear of the present populated area of the city, while future lines, built through areas now open, as these areas build up, will also reach the center of population by equally short routes.

In designing the ultimate distribution system the city is divided into three zones: first, that in which the most distant point is 25,000 feet from the pumping station; second, that in which the most distant point is 33,000 feet from the pumping station; and, third, that in which the most distant point is 50,000 feet from the pumping station.

The main lines supplying the first zone are designed to have frictional losses under maximum discharge of 4 feet per 1,000; in the second of 3 feet per 1,000, and in the third 2 feet per 1,000; so that with a little over 200 feet head at the pumping station the pressure at the most distant portion of either zone will not fall below 100 feet.

For present construction only the smaller mains intended for the supply of the first zone will be required, while the big main eventually intended for the second zone alone will supply both the second and third, all being sufficiently cross-connected by valves so that they can be worked either together or independently, as experience or temporary necessity may require.

The arrangement of valves and cross connections on the distribution system is devised with a view of being able to shut off pipe lines into about four block lengths. Fire hydrants are being placed one at each street intersection, always on the upper river corner just beyond the property line, the average distance apart of street intersections being about 350 feet. In the business section about as many more hydrants will be placed, the additional hydrants being located close to the street corner diagonally opposite to that upon which the regular hydrant is set. Valves are always set opposite the property line, the pipe being cut to maintain a standard location. Hydrants are never taken off any line smaller than 6 inches in diameter, said line being not more than four blocks long and fed at both ends usually by 12-inch lines or larger. In the business section larger sub-mains are to be used. In the residence sections of the city hydrants are 4-inch supply and barrel, with two 2½-inch hose nozzles; in the business section they are 6-inch supply and barrel, with two 2½-inch and one steamer nozzle. The Matthews compression hydrants is being used throughout.

The insurance insterests have urged the use of large pipe, larger hydrants and infinitely more complicated and expensive valve and cross connection arrangements; also higher pressure. The Sewerage and Water Board, however, has to consider the cost and the other uses for a water-works system, and while they would like to be able to build the finest distribution system for fire protection in the country they cannot afford to go the lengths advocated by the insurance interests, nor can they ignore the fact that very high pressures mean waste and great inconvenience in general use. The present layout will probably allow of the concentration of steam fire engines in or near the business center of the city, where high buildings and congested values demand their service, while hose carts will suffice for fighting ordinary fires in the residence section, the pressure and quantity of water available being adequate to throw very effective fire streams without the use of steam fire engines.

Contracts are now under construction covering about 135 miles of the new water distribution system.

The contract for pumping machinery was also let about a year ago to the Allis-Chalmers Company. This contract will include four 20,000,000 gallons vertical triple expansion crank and fly wheel pumping engines of the highest type; also one 20,000,000-gallon and three 40,000,000-gallon low lift centrifugal pumps, all driven by horizontal compound condensing engines and two direct connected generators similarly driven to operate cars, elevators, etc. There will also be 2,400 horse-power Heine water tube boilers, with automatic stokers. The cost of the above mechanical equipment will be about $500,000.

Bids have just been received for the construction of the water prification plants, one of 40,000,000 and one of 4,000,000 gallons nominal capacity, and the pumping station buildings, intakes and coal and coagulant handling equipment. The lowest bid for this contract amounted to $1,840,000. The time allowed for its completion under the contract is 28 months, with a "bonus and forfeit" clause of $200 per day as an incentive for rapid execution.

You will note that the "plural" is used in referring to "water purification plants, etc." The city is located on both sides of the Mississippi River and about 20,000 of the population live on the west bank in the "Fifth Municipal District," which is carefully "included" in the law which defines the duty of the Sewerage and Water Board, so that everything has to be duplicated on a small scale both in water, sewerage and drainage construction.

The proposed water purification plants are rather difficult of brief and satisfactory description. They are along the general line of modern plants of this character. Reservoir walls, filters, etc., are to be constructed of reinforced concrete, founded on piles for the most part, since the bearing power of the ground at New Orleans is usually assumed at not over 1,200 pounds per square foot.

Low lift pumps will take the water from the river through an intake, built at the low water line and arranged always to take water from the surface, through a level suction line laid with its top about 3 feet below ordinary low water level, and discharge it into the "head house," where its subsequent movements and the application of coagulant, etc., will be governed.

The ordinary course will be, first, through the grit chamber, where subsidence will eliminate any very heavy suspended matter, then via the head house through submerged orifices, which measure the quality passing and, by automatic connections, regulate all chemical feed in proportion to the quantity of water passing. At this point milk of lime is added and the water passes to and through the lime-mixing channels where it is kept in motion for another hour at a velocity sufficient to prevent subsidence and to effect such mixing and commingling of the milk of lime as will complete the required chemical action. While the water is still in the lime-mixing passages any soda necessary for the elimination of the contained sulphates is also added.

After an hour in the lime-mixing passages the water returns to the head house and is passed to the coagulating reservoirs, holding about seven hours' supply, where subsidence, due to the coagulating effect of the lime, is obtained and where additional coagulant (sulphate of iron) is added at such time or times and in such quantity as is necessary to produce a water properly prepared for filtration. Then again through the head house the water passes onto the filters.

The above is a continuous process with water constantly entering and leaving each department. Grit chambers, lime-mixing compartments and coagulating reservoirs are in duplicate, and a clean-out system of cast iron pipe, connected with an electrically-driven centrifugal pump, is placed under all parts of the system for the removal of the deposit formed. Roughly speaking, when the water consumption is 40,000,000 gallons per day the deposit in the reservoir should be enough in a year to fill four ordinary city squares about three feet deep.

In passing through the filters the flow of water will be automatically regulated between fixed limits, say from 3,000,000 to 6,000,000 gallons per filter unit (4,000,000 gallons would correspond to a rate of filtration of 125,000,000 gallons per day per acre), so that within these limits and by such gradual changes in rate as cannot effect the efficiency of the filters they will tend to respond to the demands of the distribution pumps, yielding at a high rate when the equalizing clear water reservoir beneath the filters (which is directly connected with the pump well) is low and at a low rate when it is high, the arrangement being such that each filter can be placed under this form of control or set to any required rate regardless of the height of water in the pump well. As a further guarantee that water will always be available in the pump well, covered clear water reservoirs, holding about six hours' supply, will be pumped full when the consumption is low, and connected to the pump well by a 48-inch

pipe line and an automatic valve, which will open whenever the water in said well falls below a pre-determined level, thus admitting water freely from the clear water reservoirs to maintain the required minimum level in the pump well.

The investigation at New Orleans had indicated no particular advantage under local conditions in the use of air in connection with the wash water for cleaning the filters, even when the wash water was applied at only five times the rate of filtration, and experiments later at Cincinnati indicate that by doubling this wash water rate sufficient agitation of the sand layer is certainly obtained.

In accordance with these conclusions the provision for filter washing in New Orleans is to apply wash water at a very high rate, viz., 60 cubic feet per second, to a 4,000,000 gallon unit. In order to accomplish a portion of the wash at this rate without too great an increase in size of piping and strainer system, or too serious and sudden a draught upon the power in the boilers at the pumping station, it has been arranged to place two air-tight steel tanks above the filter gallery and to fill these tanks gradually from the distribution system, displacing the air in them through a check valve into a third tank placed above them, in which the air will be compressed to about 60 pounds pressure. This air pressure will then be applied to the wash water through a pressure-reducing valve, regulated to the pressure found necessary to produce the required initial wash water rate, the last or displacement stage of wash water application after the air pressure is exhausted being completed by the gravity head due to the elevation of the wash water tanks.

The development of water purification projects following the investigations at Louisville and Cincinnati in 1897 and 1898, where the first real studies were made of the combination of subsidence and chemical coagulation, with further subsidence as a preparation for effective and economical rapid filtration, has been considerable and appears to have been brought about in a most admirable manner.

The leaders in this work have been connected with numerous projects and have worked together for the advancement of the art, acting as it were as a "clearing house" to effect an interchange of all suggestions looking to improvement, preventing to a great extent any misdirected effort, and encouraging development along promising lines.

Through this "clearing house" we have seen some of the cruder ideas, which our preliminary studies at New Orleans developed, worked over, improved upon and tried out at other points, and when finally we were ready to push our plans to completion we were (through the courtesy of those in charge of various other somewhat similar works) enabled to get their complete plans and specifications.

Due to local conditions our general layout has no resemblance to any other similar project, and we have had no hesitation in departing in detail from the procedure of others whenever we have considered that an advantage could be gained. On the other hand, we have been equally

willing to take every possible advantage of the "beaten path" where it seemed to lead most directly to the ends desired, and have found especially helpful the plans and specifications which we have had from Little Falls and Hackensack, New Jersey, and from Columbus and Cincinnati, Ohio, at each of which places large plants of a generally similar character have been or are now being constructed.

The general effect which the works now in progress must have upon the health and comfort of New Orleans are well illustrated by the following facts:

The Drainage System, adequate to handle ordinary storms as they fall and to keep the ordinary level of the water in the drainage canals down to from 10 to 15 feet below the ground level, went into operation in 1900, and immediately thereafter the death rate fell from 27 per 1,000 to 21.5 per 1,000, and has subsequently remained substantially at that figure, while thousands of acres which were formerly marshes are now dry and being built upon and improved.

Where sewers are being constructed in every street and kept pumped out the seepage or ground water flow collected into them amounts to over 1,000,000 gallons per square mile of area drained per day, and the effect of this under-drainage is very marked in the reduction of the saturation of the soil, and of the normal flow in street gutters. When the sewers are fully connected the dry weather flow in the street gutters will be practically eliminated, and the vaults and cesspools now existing all over the city will be a thing of the past.

With waterworks operation the cisterns at every house, and the existing muddy water supply, can be done away with and a pure water supply, under an adequate pressure, substituted.

All of these things will make for the health and comfort of the community, and there seems to be a fair prospect that the existing death rate of 21.5 per 1,000, which compares well with other large cities, can be still further decreased.

With cisterns, gutters and marshes furnishing breeding grounds for the various types of mosquitoes which each propagates, the eradication of the types of mosquitoes which are known to spread either yellow or malarial fever, when such fever is well introduced, has been a very difficult task, yet yellow fever, very strongly started last year, was stopped by a systematic oiling and screening of cisterns and oiling and salting of other standing waters.

The magnitude of such a mosquito campaign over an area of 33 square miles, with 800 miles of street gutters and 65,000 cisterns, many of them two or three story affairs, is obvious, and with our present knowledge of the advantages to be derived by the practical extinction of the Stegomyia and Annopheles mosquito, and the comfort at least arising from the removal of other types, the construction of Sewerage, Water and Drainage Systems in New Orleans would be warranted if this alone could be accomplished.

That these systems will be effective in this direction, as well as in a general sanitary improvement, is beyond any doubt, and it can be confidently predicted that the New Orleans of the next decade will deserve and have a sanitary reputation which will enable her not only to retain her present prosperity but to increase her rate of development in proportion to the magnificent opportunities which lie before her.

MR. HATTON: I move the thanks of this Society be extended to Mr. Earl for this very valuable paper.

Motion seconded and carried.

THE PRESIDENT: We will now have the pleasure of listening to Professor Kay, on the subject of "Chert Roads."

CHERT ROADS.

BY PROF. EDWD. S. KAY, TUSCALOOSA, ALA.

"Chert or flint is one of the hardest of rocks"; it does not usually occur in considerable quantities in its original beds, is everywhere mixed with more or less limestone or sandstone, so that beds of pure chert often grade imperceptibly into pure limestone or pure sandstone. Determinations made by the Department of Agriculture at Washington, Office of Public Roads-Division of Tests, give the following maximum and minimum results of some thirty samples, corrected to July 1, 1906:

Chert.	Maximum.	Minimum.	Average.
Specific gravity	2.90	2.00	2.50
Weight—Pounds per cubic foot	180	125	156
Water absorbed—Pounds per cubic foot	11.10	0.46	
Per cent. of wear	27.89	2.7	
French co-efficient of wear	14.6	1.4	
Hardness	19.6	19.1	
Toughness	21.0	7.0	
Cementing value—Dry	36.0	1.0	
Cementing value—Wet	106.0	5.0	

These tests made by the Government Office of Public Roads, show that chert exceeds in hardness any material ordinarily used for road building. The cementing valve tests of chert do not compare favorably with trap rock, limestones and other road materials, since the essential mineral of chert (which is quartz, a mineral of practically no cementing value) represents from 83 to 99 per cent. of the composition. However, the accessory and secondary minerals of chert, such as pyrite, magnetite, limonite, calcite, and chlorite have high cementing values, and cherts when used as road materials almost always increase in cementing value after being exposed to traffic.

Chert has a splintery or conchoidal fracture, and in color ranges from pure white to black, neutral grey, brown, yellow or red.

It is found in the Lower Carboniferous formation and in the Knox Dolomite of the Silurian or Cambrian. In the former it is generally in more or less regular beds or sheets; in the latter, usually in the form of concretionary masses. Geographically it is found in the sub-Carboniferous and Silurian outcrops in Alabama, and extending through the northeastern part of Mississippi, thence through Tennessee, following closely the Tennessee River through western Kentucky, crossing southern Illinois and Missouri, then down through the State of Arkansas and into Oklahoma. The name of hornstone was more frequently employed for the same substance. In Illinois it is known sometimes as novaculite, but is unlike the true novaculites found in the hilly regions south of the Coal Measures in Arkansas from which the famous Arkansas whetstones are made.

There are extensive chert quarries in Alabama, near Florence, Ft. Payne, Birmingham, Leeds, Bessemer, Anniston, Jacksonville and other cities and towns. In the Birmingham District it is found in inexhaustible supply, overlying the red sandstone, which forms the covering for the big vein of red hematite ore and underlying the sub-carboniferous limestone. The chert of the sub-carboniferous formation, contains between the cleavage joints, a proportion of clay and iron oxide, and although the bank chert is sometimes comparatively soft until it is spread on the ground, it generally makes a better roadway than the hard material. In Alabama, the chert from the Silurian formation is harder and more expensive to quarry and does not make as good road material as that from the upper formation. All the cherts of Alabama are easily quarried, however, by blasting, and the lumps are reduced to proper size by napping hammers or by rolling. There is an extensive chert quarry in Tishomingo County, Miss., and in Alexander County, Illinois, at Elco, there is a chert bed about 150 feet in hickness. It is located on the Mobile & Ohio Railroad about 24 miles above Cairo. The chert is obtained by blasting, is run through a crusher and loaded on cars by the use of steam shovel. This chert besides being used as a road material, is used as ballast on the St. Louis division of the M. & O. R. R. and to replace wooden platforms at stations. "Where cherts are found in banks or beds of streams, they are commonly called gravel. Creek gravel, formed from chert or novaculite, is usually of uniform size and comparatively clean, while the bank gravel often contains earthy matter and fine particles of the same material. The creek gravel usually wears the best, but it does not bind so readily, or form as smooth a surface as the bank deposits." These gravels are widely distributed over southwest Missouri and in Jasper County the cherty refuse from the zinc mines is utilized for road-making. In Arkansas the cherts (in place) are confined to the area lying north of the Boston Mountains and west of the Iron Mountain Railway. "There are two horizons at which it occurs in large quantities; the first is that of the Boone chert and cherty limestone lying at or near the base of the Carboniferous

series of rocks; the second is the great chert beds lying far below the Boone chert, geologically speaking, and exposed in the counties through which the upper White River flows The Boone chert begins in Independence County, near Dota, and forms a belt of ragged edges from 5 to 15 miles wide, crossing the State from this point, past Cushman, Mountain View, Marshall, Harrison & Eureka Springs, and forming the greater part of the surface of Benton County. All through these chert regions the beds of the streams are filled in places to a depth of 15 feet with the accumulated small fragments of chert, most of which is in a suitable condition for immediate use for road building." The chert beds that occur in the Silurian rock of north Arkansas "crop out along the stream bluffs through Randolph, Sharp, Fulton, Izard and Baxter counties, and large quantities of the broken fragments accumulate in the beds of streams where they are often in excellent condition for road metal."

CHERT AS A ROAD-BUILDING MATERIAL.

Chert, as we have already noted, varies greatly in quality and appearance and upon exposure becomes hard and tough, offering a strong resistance to abrasion. The Alabama cherts which contain clay and iron oxide between the cleavage joints are easily and cheaply quarried, do not require crushing. bind together readily and make cheap roads that wear well and are smoother than roads built entirely of limestone. Mr. Sam C. Lancaster, Chief Engineer of the Madison County, Tenn., Good Roads Commission, commenting on Chert in his "Report on Road Building in Madison County, Tenn.," says: "This material seems to have been prepared in Nature's Laboratory especially for road building." Judged by the qualities required of an ideal road, we find this material to satisfy as many conditions, if not more, than any other material that is extensively used in road building.

It is low in first cost, as it is easily mined. The total cost on board cars at pits in the Birmingham District does not exceed 25 cents per cubic yard.

It requires no preparation, except breaking up of the larger masses, which is usually done by rolling or by napping hammers.

It is more durable than any form of dirt or macadam road.

It produces a road surface that is very smooth, of considerable elasticity, but hard enough to have a low tractive resistance.

A chert road does not rut under any condition of traffic. An examination of the highways in Jefferson County, Alabama, which have been built of chert and were constructed over twenty years ago, and many of them subject to heavy traffic, will show that these roads are still smooth and in good condition, although they have had practically no repairs.

Chert does not produce a slippery road surface, and it affords a good foothold to draw heavy loads.

It can be used on any grade. It makes a comparatively noiseless road and yields neither dust or mud.

It makes an impervious roadbed and being smooth drains rapidly.

Of light color, it does not absorb heat excessively. The color of the surface is pleasing and does not produce glare.

"Where the material is plentiful, and where a good quality of bank gravel is available for a binder it is not necessary to go to the trouble and expense of cutting out a sub-grade or to prepare earth shoulders as is done for regular macadam. It is, however, essential that the surface course contain a sufficient quantity of good binding material, otherwise the bond will soon be broken, the material will spread and much of it will eventually be forced or washed into the side ditches." John C. Branner in his Report on Road-Making Materials in Arkansas, says: "The 'ridge roads through all the chert regions of the state bear witness to the great value of this chert as a road-making material. These roads, though seldom or never repaired, are hard, compact, dry and free from mud and dust all year round. The gravelly roads on the hills about Eureka Springs are all of this Boone chert. The best roads in Benton, Carroll, Boone, Marion and Searcy counties are on this same formation."

METHODS OF CONSTRUCTION.

Mr. M. O. Eldridge, Chief of Records U. S. Office of Public Roads, in June number, 1906, of Good Roads Magazine, says: "The roadbed should be shaped with a road machine before the material is placed and given a slight crown of from ⅜ to ½ inch to the foot from the center to the sides. The foundation should then be rolled, the material for the first course spread in two layers and rolled and sprinkled in the usual manner. The spreading of the material can be accomplished by the use of a road machine, provided the gravel is not too large. The total depth may vary from 4 to 9 inches at the center, as soil and traffic may require, and gradually diminish in thickness to what is commonly called a 'feather edge' at the sides." "If the most approved method is followed, shoulders should be provided to hold the material in place. The material should then be spread to a uniform depth from the center to sides." During the year 1904 the Office of Public Roads built three chert roads in southwest Missouri, at Lebanon, Springfield and Neosho. A complete account of the Springfield road, giving methods and cost will be found in the Good Roads Magazine for April, 1906. The Neosho rock was easily broken by napping hammers or the steam roller and the Neosho road was built of uncrushed chert. The completed road, which was 12 feet wide and 2,640 feet long, contained 3,520 square yards of material and cost, including two culverts, 43 ctnts per square yard, or at the rate of $3.058.22 per mile. Total depth of the two courses of chert, consolidated, 7 inches. For full description of this road, see Good Roads Magazine, June, 1906.

A full description of the Madison County, Tenn., Chert roads, built under the direction of Mr. Sam Lancaster, will be found in the Yearbook of Department of Agriculture for 1904. Material for the Madison County roads was obtained in Alexander County, Ill. Solid foundations were

first obtained by rolling. First course of stone put on 4 inches in thickness. The rolling was from the edges toward the center. Second course of finer material was put on 2 inches in thickness. The last course used being fine screenings, which was sprinkled and rolled until the whole is thoroughly compacted, having a thickness of 6 inches at the center and 4 inches at the sides. The cost of the chert per cubic yard delivered on cars at Jackson was about $1.60. The average cost of grading, preparing foundation, rolling, unloading stone, hauling it to the road, and laying it complete was $1,800.43 per mile.

CHERT ROADS IN ALABAMA.

A full description of the early methods of building chert roads in Jefferson County and Birmingham, Ala., will be found in Engineering News, Vol. XXX, No. 45, Page 370, by Julian Kendrick, City Engineer of Birmingham. Those roads were built without any attempt to consolidate the foundation or to compact the chert. There are probably over 200 miles of chert roads in Jefferson County with widths varying from 16 to 24 feet. In 1887 the Gate City Land Company cherted about a mile of street, which is a part of the county road system, and the road was extended in both directions, using the same material. Although there is a heavy traffic over this road as any in the country, and it has been in constant use for 19 years, with little or no repairs the road is still in good condition. The county roads were originally built by placing upon the sub-grade, limestone crushed to pass through a two-inch ring and spread 9 inches thick in center and 6 inches in thickness at the edges; over this was spread a layer of chert from 3 to 4 inches in thickness, which under traffic soon formed a smooth cemented roadway. The county has never owned a roller and none has been employed on any of the roads. The present practice is to place furnace slag upon the sub-grade which is crowned 6 inches at center and from 12 to 18 feet in width, the slag being put on 6 inches in thickness at center and about 4 and one-half inches at sides. Chert is then placed 4 inches in thickness at center and about 2 inches on sides. The City of Birmingham has about 40 miles of chert streets or roads. Some of these streets were built by simply forming the natural material of the street and compacting it with a steam roller. The roller used by the city weighs 15 tons, weight on each 20-inch wheel 6 feet in diameter, being 5 tons. On all cherted streets a foundation course of slag is placed on the well compacted sub-grade. The slag delivered and rolled costs 80 cents per cubic yard, put on 4 inches in thickness or nine cents per square yard. The chert costs from seventy-five cents to one dollar and twenty-five cents per cubic yard on street in place and rolled. It is spread on an average to a thickness of five inches in center and decreased to three inches at sides and rolled until smooth and compact. The center rise or crown, where chert is used at Birmingham, is about one-thirtieth of the width of street measured from outside of gutters. Gutters are three feet wide measured from outside

edge of curb. On grades, a little in excess of one-thirtieth of street is used to determine center rise. There are streets in Birmingham with grades as high as fifteen per cent., on which this material has been placed.

The chert now being used at Birmingham comes from banks near Bessemer. It costs about sixty cents per ton f. o. b. cars Birmingham, including freight charge of twenty-five cents per ton, and weighs about twenty-eight hundred pounds per cubic yard on cars.

In Jefferson County where slag is not available, the foundation course is made of the harder and courser portions of the chert used and placed from four to five inches thick; the top course being the same as where slag is employed for a foundation.

At Cairo, Illinois, the Elco chert was used on Commercial Avenue, the chief business street, on a sand foundation—thickness of chert compacted about eight inches. It has been placed for a number of years and the street is still in excellent condition. Eighth Street in the same city was improved by placing a six-inch course of uncrushed chert on the sand foundation and a two-inch top course of chert crushed to pass a three-quarters inch mesh. This street after four years' use is smooth and in excellent condition.

THE PRESIDENT: We will now have the pleasure of listening to the report of the Committee on Waterworks and Water Supply, by Mr. Julian Griggs, and also a paper entitled "The Cost of Clearing and Grubbing a Reservoir Site," by same member.

REPORT OF THE COMMITTEE ON WATERWORKS AND WATER SUPPLY.

BY JULIAN GRIGGS, CHAIRMAN, CONSULTING ENGINEER, COLUMBUS, OHIO.

In noting the signs of the times in the matters of water supply and waterworks your committee sees no diminution of the trend toward public as against private ownership of these utilities which has been so decided in recent years. Doubtless an array of statistics to show this trend by tables or by curves would be of some interest to the engineering profession, but the committee have gathered no such data; it has been contended with listing a few of the obvious tendencies of the present for the purpose of marking time, which is one of the functions of our convention.

During the year committees have been appointed from many of the state and local engineering societies and clubs of the middle west for action in common looking to a prevention of stream pollution. Not much can be said as yet to have been accomplished, but as betterments are dependent on the growth of an approving public opinion which is necessarily slow in forming the co-operation of many influential societies

as noted is a distinct gain, which will tend to greatly hasten an improvement in the sanitary condition of our streams. A reform desirable from sentiments of cleanliness and decency, but also as a matter of public health, because with the rapid increase of population in our cities, surface waters from the rivers and streams must in the future be more and more utilized for municipal water supplies.

The general government is continuing important and useful work in the records of stream discharge and turbidity, to which has been added studies by specialists on the underground sources of supply in various sections. These underground sources are important, generally the cheapest in development, and most satisfactory for the smaller communities.

FILTRATION.

It will not be amiss to mention the large cities of America having plants for water filtration either in course of construction or recently completed. They are Louisville, Ky., Cincinnati and Columbus, O., Pittsburg, Harrisburg and Philadelphia, Pa., Washington, D. C., Providence, R. I., and New Orleans, La. And there should be added some works by private water companies, such as the East Jersey, Hackensack and New Haven companies with an aggregate normal daily capacity of 68 million gallons, supplying the cities of Paterson, Passaic, West Hoboken and Millville, together with a number of smaller communities in Northern New Jersey, and New Haven, Connecticut.

Very large sums of money have been and are being expended for the purification works ljsted, generally under adequate plans and with competent engineering direction. The number of cities to engage in similar undertakings in the near future is believed to be great, and the specialists now engaged in this line of work or in training for it are likely to have a busy time.

WATER SOFTENING PLANT.

There is said to be but one municipal water softening plant in the United States—located at Oberlin, Ohio, a village of about 4,000 people, requiring 165,000 gallons of softened water per day, and only three such in the world. The largest is at Southampton, England, a city of some 70,000 population, with works of four millon gallons daily capacity, in operation since 1888, and the other at Winnipeg, Manitoba, a three million gallon plant which went into commission in 1901.

It is perhaps not surprising that municipalities have not been more progressive in softening their waters for the reason that the sanitary cleanliness of a city water supply is of vastly more importance than the economic gains to be had from a soft water and our cities have been very slow to perceive and follow their duty even with respect to the former.

VALUE OF SOFT WATER.

It is surprising that our railway companies have only in recent years awakened to a realization of the advantages of a soft water for use in

locomotive boilers, considering how they were daily forced to meet the losses due to hard unsuitable waters, although the softening process had been known for half a century. The railway companies have, however, in recent years been calling into their service many young men from our universities who have been trained to think, and to this fact may be due more than has heretofore been acknowledged the improvement noted in railway practice.

ILLUSTRATING THE SAVING.

An anecdote here will illustrate the point to be emphasized. It concerns a woolen factory said to have been located somewhere in Michigan. For years the proprietor used in washing his wool an extremely hard surface water, but presently, for the comfort of his operatives, developed an artesian supply which proved cool, abundant and soft. He, however, continued to wash his wool with the hard surface water until some bright commercial traveler, in passing through the works, suggested the obvious change in method, which, when made, in a few months saved, in cost of soap required enough to pay the whole expense of drilling the well and a considerable sum in addition. The commercial traveler afterwards, in relating his observation and experience as above outlined, was asked by some listener, how he accounted for the obtuseness of the manufacturer, to which he replied, "Oh, he was one of those western hustlers and didn't have time to think."

TECHNICAL GRADUATE.

It may be noted as a promising sign of the times that in the management and operation of our water works the technical graduate is increasingly in evidence, that he has been trained to take time to think and this sign is a harbinger of good for the future of municipal water works development.

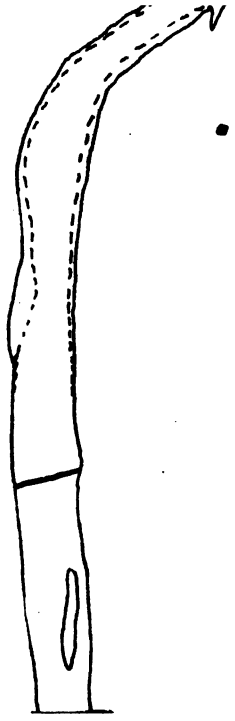
THE COST OF CLEARING AND GRUBBING A RESERVOIR SITE.

BY JULIAN GRIGGS, COLUMBUS, OHIO.

In this paper it will be the purpose of the writer to give with some detail the cost of clearing and grubbing the site of the reservoir formed by the construction of the Scioto River Storage Dam for the municipal water supply for the City of Columbus, Ohio.

The work to be described was but a small portion of the total expenditure of about $700,000 by the city for the dam and works appurtenant thereto, but the failure of the writer after a somewhat extended search of engineering literature to find descriptions of this portion of similar undertakings has led to the hope that a paper on the cost of clearing and grubbing a reservoir site will prove a welcome, though slight contribution to the subject of water supply engineering.

Cases of complete soil removal, as in the Wachusett reservoir for the Boston Metropolitan Water System, are not unknown; perhaps, how-



ever, it has never before covered so large an area and been done with quite the degree of thoroughness which there obtained, but wherever done, it is for the engineer mainly a question of estimating the cost of excavating and hauling a given quantity of earth, while the clearing and grubbing become a secondary matter as tending only to increase slightly the cost per cubic yard for excavating and removing the earth to a point outside of the reservoir.

In the Columbus case the usual conditions were reversed for the reason that the Scioto River is normally a muddy western silt bearing stream with a drainage area of 1,032 square miles above the dam and a flood discharge approximating a maxim of 50,000 cubic feet per second.

The relation of reservoir capacity to maximum stream discharge is such that the reservoir at maximum flood flow would fill and empty twenty times in twenty-four hours. It is therefore expected that silt in material amounts will be deposited in the reservoir at every considerable rise of the river and under these conditions it was not deemed necessary to remove any of the surface soil except to a very limited extent around former human habitations within the submerged area, but responsive to the requirements of the Ohio State Board of Health all vegetable growths were cut down even with the ground, being then gathered into heaps and burned, while the stumps and roots of all trees and shrubs one inch or more in diameter were grubbed to a depth of one foot below the surface and similarly gathered and burned.

The reservoir is unique in its way by being unusually long, 5 8-10 miles, for its width, which varies between 200 and 820 feet, and averages only 504 feet at the water surface with reservoir full. The river in ancient times wore out a gorge in the limestone rock of the Upper Hilderberg formation some ninety feet below the general level for a width of from 600 to 800 feet, and in more recent times has filled it in again with rich alluvial deposits to a depth of about 18 feet, through which the present stream with a descent of five or six feet per mile has cut its slightly meandering channel ten to twelve feet in depth and about 200 feet in width.

In places on either side of the gorge vertical bluffs twenty to thirty feet high for perhaps a total length, within the reservoir limits, of two miles still remain, but generally speaking the rocks forming the sides of the gorge have crumbled and now appear as steeply sloping hill sides too rugged for cultivation and for the most part covered with trees and shrubs.

From the above description it will be seen that the reservoir formed by the dam, which has a height of 33 feet from its apron to its rollway, will fill the gorge at its lower or south end 720 feet in width and only the present river channel 200 feet in width at its upper or northern end. The greatest depth of water in the reservoir is 35 feet and the mean depth is 14 feet or 40 per cent of the maximum. The area of the river at ordinary low water within the reservoir was 125 7-10 acres, while

the water surface of the reservoir at the elevation of the rollway is 351 acres.

A portion of the bottom land for an aggregate area of about 36 acres had been cultivated before it was purchased by the city, but the remainder was thickly covered with a growth of trees and shrubs common to the forests or groves of this locality and consisted mainly of elm, oak, beech, hickory, maple, buckeye, locust and sycamore, the latter especially growing to large proportions, some of them being five feet in diameter. The shrubs were mostly osage orange, willow and pawpaw and smaller growths of the trees above mentioned. The bottom lands were very fertile and everywhere in addition to the trees supported a rank growth of weeds, among which horse cane (Ambrosia trifida) predominated, growing to a height of eight to thirteen feet.

The area to be cleared and grubbed consisted then of two strips of land, one on each side of the river together with a number of densely wooded islands aggregating a total of 255 6-10 acres, 5 2-10 acres being below the site of the dam cleared but not grubbed. The outside boundary of the clearing was contour 75 feet, which was two feet above the crest of the rollway of the dam.

The base of levels was city datum on an assumed plane 100 feet below the water table of the Ohio State Capitol.

The dam, and the beginning, or south end of the reservoir, is 7½ miles northwest from the center of the city and is now reached by trolley cars with an hourly service.

Bids for the grubbing and clearing (Contract No. 3 improved water supply for Columbus, Ohio) were received by the Board of Public Service on the 11th day of May, 1904, and varied from $70 to $155 per acre on an estimated area of 270 acres, as shown more specifically in the following table, the totals ranging from $18,900 to $41,850:

Name of Bidder.	Estimated Area of Clearing and Grubbing.	Rate per Acre.	Total Bid.
Hoover & Kinnear....	270 Acres	$70 00	$18,900 00
John H. Clutter.....	270 Acres	149 50	40,365 00
Fisher & Knight.....	270 Acres	155 00	41,850 00

The proposal of Messrs. Hoover & Kinnear, of Columbus, Ohio, was accepted and a contract with them was executed June 6th. Work was begun on June 14, 1904, and carried on continuously until completed, April 5, 1905.

The method adopted by the contractors in doing their work was divided into three and at times into four operations.

First a gang called the "Trimming Gang," consisting of from four to twenty laborers, equipped with axes and grubbing hoes, under the direction of a foreman, trimmed the limbs from the larger trees as high as they could reach, cut off the smaller trees about two feet above the ground, grubbed out the brush and roots and gathered into piles everything that could be burned.

Second the Trimming Gang was followed by a "Pulling Gang," composed of from six to twelve laborers, a team of horses and a stump puller. Their work was to pull up the trees and stumps. Some of the time the same gang and at other times a third gang (third operation) cut the trees and stumps into pieces that could be readily handled, grubbed out the exposed roots and piled the whole for burning, excepting such portion of trees as were saved for saw logs.

When the work began it was thought necessary to partly season and dry the brush and wood by several weeks exposure before burning, but during the winter it was found practicable to burn everything as soon as it was cut and piled.

The stump puller used was the type known as the "Hawkeye Stump Puller," and consisted of a vertical iron windlass, operated by a team of two horses. The bed to which the end of the spindle of the drum was secured, was formed of two pieces of oak timber each 10 by 12 inches by 16 feet in length, framed into a cross with equal arms. The drum was thirteen inches in diameter and two feet in height. The spindle above the top of the drum was secured by four legs, made of iron pipe, inclined outward at an angle of about 45 degrees. At the lower ends the legs were tied together with an iron strap to prevent spreading and each was fastened to an arm of the timber bed. To the end of the spindle projecting above the legs was secured one end of an 8 by 8-inch oak timber; to the other end was hitched a pair of horses making a sweep of 20 feet radius. Dragging from this sweep, directly back of the team was a stiff stick, the end upon the ground shod with an iron point, the purpose being to hold the strain made by the sweep when the horses were standing or when taken away. With each machine there were two pieces of 7/8-inch wire cable about 100 feet in length, hooks, grips, blocks, snatch cables and so forth. Four of these machines were in use by the contractors.

In operation the timber bed was buried in the ground and to make it secure, iron pins were driven into the ground against the sides of the timbers, or the timbers were loaded with stone. The snatch cable was usually fastened around the tree to be pulled from ten to twenty feet above the ground. The cable was usually passed through a snatch block fastened to a tree near the stump puller so as to bring it into a horizontal position as it was wound upon the drum. If the tree was too firmly rooted to be moved when the strain was applied, sometimes a part of the roots were cut, but usually it was the practice to explode a charge of dynamite among the roots without releasing the strain from the stump puller. Stumps, of which there were large numbers, were harder to pull than the trees and most of them had to be broken up with dynamite and taken out in pieces. Many of the trees had roots at a considerable distance below the surface of the ground, probably due to the gradual accumulation of earth above them since the trees began to grow. Large quantities of dynamite were used. It is said that sixty sticks were exploded in removing one stump.

Fourth Operation: After the trees had been pulled and burned the ground was all gone over during the months of March and April, all loose pieces of wood were picked up, any grubbing previously overlooked was done and the grass and weeds burned.

The common harrow was found to be the best tool for breaking down and gathering the weeds. It is estimated that 3,000 saw logs were sold by the contractors at $2.50 per 1,000 feet board measure and there would have been many more if the trees had not been shattered by exploding dynamite.

The table of costs which follows is derived from the inspector's daily reports, and is believed to be fairly accurate. It shows a total cost of $40,766.75. Common labor was paid $1.50 per day of ten hours and is the largest item of cost, being 53 3-10 per cent. of the total. The next largest item is dynamite, 19 1-10 per cent, followed by foremen, 8 2-10 per cent., and horses, 8 1-10 per cent.; machinery, 4 4-10 per cent.; accounted for all but a remainder of 6 9-10 pr cent., which is divided among superintendent, dynamite men, time-keepers, blacksmith and carpenter. The cost per acre therefore for the work done was $159.50.

Item.	Days.	Rate.	Total.	Per Cent. of Cost.
Superintendent	255	$4.16⅔	$1,062.50	2.6
Time-keepers	255	1.75	446.00	1.1
Foremen	1,030	2.50	3,325.00	8.2
Blacksmith	205	2.00	410.00	1.0
Carpenter	54	2.00	108.00	.3
Dynamite-men	435	1.75	761.25	1.9
Laborers	14,491	1.50	21,736.50	53.3
Single horse	222	1.50	333.00	.8
Two-horse team	847	3.50	2,964.50	7.3
Dynamite	68,000 lbs.	.11½	7,820.00	19.1
Machinery and repairs			1,800.00	4.4
Total cost			$40,766.75	100.00

Cost, per acre, $159.50.

The final estimate given May 17, 1905, was for 255 6-10 acres at $70, $17,892.

In addition to the above there was paid to the contractors $1,685.10 for doing work outside of the contract, the following amounts being cost to contractors with 15 per cent. added for use of tools and profits.

Building guard fences along public highways at dangerous places	$230.48
Removing trees and stumps from the river	283.75
Clearing the city's land above contour 75 feet	1,157.51
Miscellaneous work	13.36
Total	$1,685.10

The season was unusually favorable for the prosecution of the work as there were no delays and very little additional expense incurred by reason of high water.

The foregoing table indicates that the contractors lost a comparatively large sum of money in the execution of their contract but they never showed any disposition to slight the work or endeavored in any way to diminish to their advantage the amount thereof, neither did they permit the work to drag along, as not infrequently happens under such conditions, but prosecuted with energy and completed the same within the time limits of their contract obligation, for which honest endeavor they are entitled to and should receive great credit.

ENGINEERING.

Prior to the beginning of the work by the contractors a line of levels was run on each side of the river and stakes set to indicate on the ground the position of contour 75 feet. These stakes were set as often as there was a change in the direction of the contour and were from 50 to 400 feet apart. As an aid to finding them again they were numbered consecutively from the dam. To check the work the two lines of levels were connected at intervals of about a mile.

After the land had been cleared, survey lines were run one on each side of the valley near contour 75 feet, and the contour stakes previously placed were located by right and left measurements. Survey lines were also run on each side of the river from which the shore line of the stream was similarly located and to check the work all of the survey lines were tied together at intervals of about a mile. Contour 73 feet was also run and a careful observation made to be sure that no grubbing had been omited below that elevation. All survey lines were then platted and the areas having been computed by latitudes and departures were checked by planimeter measurement on the plats which were made to a scale of one inch equal to one hundred feet.

ADDITIONAL WEED CUTTING AND BURNING.

In May, 1905, the site of the reservoir was practically cleared of all vegetation and ready to be filled which by the requirement of Contract No. 1, for the dam was to have begun by the middle of that month. The work on Contract No. 1 had not been prosecuted at the rate stipulated in the specifications and was further delayed during the summer so that by the middle of August the whole reservoir site was covered with a luxuriant growth of weeds, some of which measured thirteen feet in height, and it became necessary to remove them before the reservoir could be filled.

An unsuccessful effort had been made the previous season to burn the dead weeds as they stood upon the ground. Neither would they burn when broken down. The city therefore engaged a foreman with a gang of seven Italian laborers to cut the weeds and after they had sun dried, to gather into piles and burn them. This work began August 21, 1905,

and was continued until water was running over the completed crest of the dam on the 6th of the following December.

Where possible a horse rake was used in gathering the weeds but where the surface could not be raked manure forks were used for this purpose.

Shortly prior to December 6th a day was fixed for dedicating the dam and it was then determined to fill the reservoir as speedily as possible. A large gang of extra men with tents and supplies were sent to the reservoir to rapidly complete the weed cutting and cleaning then being prosecuted by the city foreman and his small gang.

The cost to the city of the work so done between August 21 and December 5, 1905, was $1,969, divided into labor, tools and supplies, as shown in table following:

Item.	Labor.	Tools and Supplies.	Total.
Small Gang	$1,210.13	$43.50	$1,253.63
Large Gang	428.78	286.66	715.44
Total	$1,638.91	$330.16	$1,969.07

It will be seen then that for clearing and grubbing of a reservoir site under the conditions which obtained in the work herein described and neglecting the general expense of the contractors the cost with common labor at 15 cents per hour, may be reckoned at $159.50 per acre, to which there may be added for extra work required a further cost of $6.73 per acre. And if the reservoir is allowed to grow up with weeds and needs to be again cleaned the added cost will be $7.86 per acre or a total for all work done of $174.09 per acre for the area covered. in which is included none of the cost of engineering and inspection.

For the very efficient supervision of the execution of this contract and the carefully prepared cost records and description as stated in the foregoing paper, I am indebted to Mr. F. B. Edwards, resident engineer in charge of the work under the direction of the writer, as Chief Engineer of the Board of Public Service of the City of Columbus, Ohio.

A map of the reservoir to a scale of one inch equal one thousand feet accompanies this paper.

THE PRESIDENT: This paper is now open for discussion.

MR. SHERRERD: Having on several occasions been a member of the Committee on Water Works and Water Supplies of this Association, and knowing the difficulty of getting a paper that would be of general interest on this subject from the membership of Society, which to a great extent has been more interested in pavements and sewerage questions, it seems to me that the Society owes a good deal to the present chairman of this committee for

the able papers that have been presented on this subject. In connection with the preparation of reservoirs, this one item of grubbing and clearing has been one which the contractors, I think, have always found a difficulty in estimating, and I think that one of the functions of this Society has been very well served by the able paper which has just been read, because it will give a basis on which work of this kind can be computed. The chairman also presented a paper on another subject of the water supply problem, which is of particular interest to me in its reference to the water treating problem; I think, however, that the paper omitted to mention one of the principal plants, for this purpose, which is now under construction at Reading, Pa. This problem of treating the waters in order to make them useful for domestic purposes where they are particularly hard, is one which has only been given attention during the last few years. I know in one case where the question of the hardness of the water may perhaps be considered as an element in the value of the plant; some of the experts in the case have figured out that the value of a soft water as compared with a hard water is equal to ten cents per point per million gallons, and in this particular instance where the hardness of two relative waters which were available differed by ten points and another by 110 points. He considered that the softer water was worth $11.00 per million gallons more to that city or to a city, than the hard water. I am rather inclined to differ with the scale of comparison, but I think we ought to feel that some relative comparison in dollars and cents is applicable to such a situation. The degree of hardness may perhaps be better measured by the kind of consumption to which the water is put; that is, if it is a manufacturing city, where the hardness is a material element, and where a large quantity of water is used, in the laundry business, for instance, or in some other manufacturing pursuits, where the element so enters materially, then it is a proposition more important to consider the dollars and cents point of view in connection with the comparison of those waters. But, there is also another element to be considered, and in this case to which I refer, the element did enter into the construction of the case; that is, the water that had only been

used was one which formed rather hard scales on the boiler, and the same reason supplied while harder to a degree of 110 points than one which formed a soft deposit on the boiler and could be blown off, in point of fact the results were more advantagegous for those he had occasion to use the harder water in boilers, than for those who had formerly used the softer water. I would also like to refer to a case that may be of interest in connection with the effect of sulphur more particularly on the seviceability of waters, to a condition which was brought to my attention some two years ago, where a railroad had an extended store yard which was used for the making up of freight trains. In the early years of the use of this yard, the company had been in the habit of getting their water supply from an underground source, which was the accumulation of the water which fell under their limited area as to freight business and coal business and the storage of cars in this yard, and also the storage of coal, which you will know is now being carried on by almost all of the railroads who center around the metropolitan district, increased the rain flow which came down on these yards a greater amount of sulphur into the ground water to such a degree that it became absolutely necessary for the railroad to abandon their previous water supply and resort to some other supply over the territory which was not impregnated with this sulphur. I mention this case because I think perhaps many members of this Society may have run into the same condition, and that it is always advisable to take into account the changes of local conditions which may affect the water supply. (Applause.)

THE PRESIDENT: Any other discussion?

MR. CRANDALL: It may be of interest to the members of this Society to know that a brewing company in the City of Dayton, Ohio, where the water supply is exceedingly limited, as most of us know, found it necessary to provide some means for getting the lime out of the water, and the proprietor devised a system of his own, which simply consisted in raising the temperature of the water to just the required degree in boiling point to cause the lime

to settle on the pipes that extended along about fifty feet; the water run in the tube in thirty pipes through which the steam run, raising the temperature of the water, so that the lime would be deposited on the pipe, run out a little sluice-way and that sluice-way was provided with stone, and the lime deposited on the stone, and could be pushed away. The lime was extracted from the water by that process, and after reaching the vat in the other room, it was put through some process by which nearly all the lime was extracted. The water was sold at so much per barrel; sold as white rock is being sold, and as pure spring water is sold, and it was a profitable investment. I visited this plant some years ago, and it was a very interesting thing.

THE PRESIDENT: If there is no further discussion, we have other business to take up.

THE SECRETARY: Mr. President, I would like to bring up the amendment to the Constitution. That is, to amend Section 1 of Article 7, so that the meeting of the Society should be held on the second Tuesday in October, instead of the second Wednesday in October, and I would like to move the adoption of that amendment. Seconded and carried.

MR. RUST: I have a resolution here the adoption of which I wish to move; it was omitted last evening; can I bring it up now?

THE PRESIDENT: Yes, sir.

MR. RUST:

Resolved, That the Secretary be instructed to extend to the American Civic Association and the National Municipal League invitations to hold their conventions for 1907 at the same time and place as this Society, and that he be authorized to make the necessary arrangements in conjunction with the local committee in case these invitations are accepted.

THE PRESIDENT: Any discussion of this motion, gentlemen?

MR. REIMER: Mr. Chairman, I was present at the meeting of the Municipal League in Chicago and know that they voted to go to Norfolk for their convention. Is it not superfluous for us to invite them to meet with us next year?

THE PRESIDENT: That was the American Municipal League?

MR. REIMER: Yes, sir.

THE PRESIDENT: The invitation is to the National Municipal League. Any further discussions?

MR. REIMER: It is not exactly a discussion, but I would like to say for Mr. Rust, and probably other Past Presidents, that the Civic League and some other societies working along the line of municipal improvements in various directions, have for several years been trying to co-operate with this Society in some line or another, I think. Although the Society has never in the past felt like any intimate association with the other society, it does seem to me that it would be a very good plan for us at least to meet in the same place and get acquainted with each other, and possibly that would be the best opportunity to give the subject some more consideration and thought, which has not at all been done in the past. I do not think any more intimate connection with the Societies would help us, but would not hurt us any.

A MEMBER: Michigan has a league of municipalities which has no connection whatever with the national organization,—it is made up of mayors, heads of departments, city engineers and aldermen of the leading cities of Michigan. I have known of its work for several years, and it struck me that if we could get them to meet with us at the same time, without in any wise affecting our organization, it would make the meeting more successful. If the mover of the resolution would accept the amendment. I would move that it include the League of Michigan Municipalities.

THE PRESIDENT: The Chairman may suggest that it would be to the effect—that while an invitation to these two societies would be something different to the League of Michigan Municipalities. One may lead to the meeting together or in the same place, while the League of Michigan Municipalities would be only for the one meeting in Michigan, and my suggestion would be that the matter be left with the Executive Committee as to the invitation to the League of Michigan Municipalities.

MR. DAVIS: That league always meets in the spring, in February or March, and it would be useless to consider the changing of the meeting of that society, as it always meets at that time.

THE PRESIDENT: If there is no further discussion, all those in favor of the motion make it known by the usual sign, those opposed, no. Carried.

MR. SHERRERD: May I now bring up the matter referred to in the report of the Committe on Fire Protection,—I would like to offer the following resolution:

WHEREAS, The following associations, namely, the: National Board of Fire Underwriters, National Fire Protection Association, International Association of Fire Engineers, North Carolina State Firemen's Association, National Firemen's Association, New England Water Works Association, Penna. Water Works Association, and the American Water Works Association, have approved of a standard thread for hose couplings, hydrant nozzles and other standards in the interest of a more uniform fire protection service; therefore, be it

Resolved, That the American Society of Municipal Improvements hereby recommend the adoption of a standard thread for fire hose coupling and hydrant nozzles of 7½ threads to the inch on a male coupling or hydrant nozzle of 2½ inches internal diameter and an outside diameter of 3 1-16 inches and the necessary details essential for the guidance of manufacturers; be it further

Resolved, That this Society recommend that in general minimum size of hydrant connections be not less than six (6) inches in size; and be it further

Resolved, That the top circumference of hydrants bear in raised letters in a suitable place surrounding the operating nut an arrow at least 2½ inches long and the word "open" in letters at least ¾ inches in height, and that hydrants open to the left, but that all hydrants in each city open in the same direction.

MR. SHERRERD: I move the adoption of that resolution.

MR. REIMER: I would like to ask one question. Mr. Sherrerd's figures provide that no hydrant connections should be made with less than 6-inch pipes, and 6-inch pump connection with hydrants. In some of our cities four-inch pipes are laid, and we realize possibly that that should not be, but they are there, and the question that arises in my mind is whether that could apply.

MR. SHERRERD: This is only offered as a standard. I believe it is advisabe for an association like this to get in line with the other national associations. The matter was seriously considered by the American Water Works Association, and it was believed that while such a recommendation was somewhat radical in its nature, yet the importance that the insurance people are attaching to the improvements of water supplies for fire protection purposes, made it essential that that association at least should put itself upon record as establishing some criterion by which a superintendent of a water plant might know what he was expected to do; and the reason I offer this resolution and ask its adoption by this Association for 6-inch pump connections to hydrants is because the Committee of Twenty of the National Fire Protection Associations, which has been making examinations of many of the larger cities in the country have made very extreme recommendations, and their recommendation is in the line that no hydrant should be supplied with less than 8-inch connection, and all hydrants in the business sections of a city be 12 inches at least, and their recommendation was so radical that it seemed somewhat essential that some measure that should be expected from the cities should be adopted by the national association.

MR. FOLWELL: It seems that the two propositions made here can be offered on entirely different grounds; the matter of the 6-inch connection based on fire hydrants is something which in one town has no effect whatever on any other town; if one town wants to put in 4-inch hydrant connections, it is its own business, and effects nobody but their town; and if the insurance companies are going to put up the insurance on account of the 4-inch connections, the merchants will have to stand the raise. Where you go to make a standard nozzle connection, that is something different; if this town had a four-inch hydrant connection, that's no reason why this town should not send their hose and apparatus to a neighboring town and assist that town and leave the 4-inch hydrant connection at home; it does not effect the other town at all; and if the 6-inch or 8-inch hydrant connection is called for it means at

least a 6 or 8-inch pipe in the street. I am in favor of a standard hose nozzle connection, but I am not in favor of dictating what the pipe system of a town should be.

MR. MCCARTIN: I am in favor of the motion of Mr. Sherrerd. It seems that Birmingham is going to considerable expense in changing 4-inch connections to 6-inch connections, and it is some interest to this town as to what is done in the matter of fire protection in other towns. We have seen our insurance rates raised in this town after fires taking place in other towns, and it effects us pretty severely here. You can't get water through a 4-inch pipe to put out a large fire in the business portion of the city, and the sooner all the cities get supplied with first-class engines and hydrants the sooner the insurance companies would reduce their rates in the different cities; one city would not have to pay so much more than another city. I think that is a good resolution.

MR. HOWARD: I regard this as suggestive and educational; we are not passing laws here, but what Mr. Sherrerd discloses is exactly in line as I interpret it, and I am heartily in favor of adopting his resolution into it.

THE PRESIDENT: If there is no further discussion, all in favor of the resolution make it known by the usual sign; those opposed, no. It is carried.

THE PRESIDENT: We have the report of the Treasurer and the Secretary will read it.

REPORT OF TREASURER.

OSWEGO, N. Y., Oct. 1, 1906.

RECEIPTS.

Balance on hand last report	$ 721 92	
Received from G. W. Tillson, Sec	1,110 65	
		$1,832 57

DISBURSEMENTS.

1905.			
Sept.	4.	G. W. Tillson Sec., 1904-1905	$ 200 00
	14.	A. P. Folwell	54 98
	14.	J. H. Kenehan	55 00
	14.	J. W. Ritchie	5 00
	27.	A. P. Folwell	6 00

1906.				
May	8.	S. E. Tate Co., printing	405 43	
		Bills paid in Montreal.		
		Alcide Chausse, help	5 00	
		Alcide Chausse, expense to New York	32 00	
		Charles C. Brown, expense	14 06	
		J. W. Ritchie & Co., exhibits	195 00	
		John W. Barlow, expense to New York	27 50	
		H. J. Beeman, lecturer	10 00	
		Guertin Printing Co., printing	20 00	
		F. J. O'Brien, expense treas. office	5 00	
		Exchange on checks	3 60	
		Balance this date	794 00	
				$1,832 57

F. J. O'BRIEN, *Treas.*

Approved,

AUGUSTUS F. EGGERS,
FERD. GIDDINGS,
Finance Committee.

THE SECRETARY: I have a paper, Mr. President, on Street Lighting, "Electric Street Lighting," by Mr. Jno. I. Mange, Manager of the Watertown Light and Power Co. I suggest we read it by title.

The following paper was then read by title:

NOTES ON STREET LIGHTING.

BY J. I. MANGE, MANAGER WATERTOWN LIGHT AND POWER CO., WATERTOWN, N. Y.

A special and very important department of lighting has to do with streets and other outdoor spaces. It involves not a few unusual difficulties, for there is unlimited space to deal with as well as an indefinite variety of natural and artificial constructions, and save in narrow streets bordered by high buildings, one gains little or nothing from the diffusion that is so important a factor in interior lighting; and in many instances the streets are so thickly shaded by trees that the problem of adequate lighting is very difficult and one for which local data is necessary for its solution, if it is to be done properly.

The amount and distribution of streets and the needs and distribution of the population are the controlling factors in the matter and obviously these vary greatly from place to place.

It is interesting to note that it is now about twenty-five years since

the electric arc was first applied to street lighting and it has proven itself to be really the only source of light profitable to consider.

The incandescent lamp is by no means to be thought unfit for service, as many of them are now doing admirable work in small towns, in suburbs of cities and in many blind alleys and courts where the expense of an arc lamp is unnecessary. However, at the same total cost, the arc lamp gives a considerably higher average illumination and experience shows that on the whole, arcs which have to be inspected at frequent intervals for the purpose of trimming are kept nearer their point of maximum efficiency than incandescents.

In streets where shade trees hang very low and the foliage is very heavy, arc lamps are at a great disadvantage. Here as well as in many other places where there is no real need of a brilliant light, the incandescent is capable of doing good service at a moderate cost. Economy also sometimes dictates caution in the expenditure for street lighting and in most cases recourse can be had to the incandescent.

The incandescent lamp is usually fifty, seventy-five or one hundred candle power when operated in series with the arc lamps, and sixteen, twenty-five or thirty-two candle power when worked in series upon an alternating current circuit of one thousand or two thousand volts, taking two or four amperes. It should be noted, however, that lamps so operated are costly in the matter of renewals and difficult to operate satisfactory.

In view of the rapid deterioration of the brilliancy of the incandescent, it is not wise to space them over one hundred and twenty-five feet apart for good service; although in heavily shaded streets if one hundred candle power lamps are used and placed on alternate sides of the street, the space between consecutive lights may be three hundred feet and still produce a fairly well lighted street.

This makes the first cost of installation rather high and therefore the cost per year to the city is higher, relatively, than the arc lamp. For a fifty-candle power lamp, the average price is twenty-five to thirty dollars per year.

Gas lamps have been used with considerable success much in the same manner as incandescent electric lamps are used. The old style open flame lamp was a very wasteful one burning eight or twelve cubic feet of gas per hour with little illumination

With the advent of the incandescent mantle burner, such as sold by the American Gas Light Co. of New York, gas lamps became quite popular and are used now to some extent. These lamps are economical, burning only three and one-half to four cubic feet per hour. The average price for such service is about thirty dollars per year.

They are, however, open to the objection that they must be individually lighted and extinguished. The rapid shrinking of the mantles with a diminuation of candle power is another bad feature.

Gasoline lamps with individual tanks have been put on the market, but to the writer's knowledge no success has been attained.

For about ten years the only available arc lamp was the open full arc of two thousand nominal candle power. These lamps operated at a high amperage, approximately ten amperes, with a low arc voltage, producing a powerful white glaring light near the lamp, and when fitted with clear globes offered a method of illumination which impressed and satisfied the general public who became accustomed to it and thought the more glaring the light, the better the lamp and system; while in fact the glare is the most serious objection to the open arc because of the fact that in the presence of lights of great brilliancy the eye contracts and does not recover promptly enough in passing beyond the glare to get the full value of the relatively feeble light at a distance from the lamp.

There are many other objections to the open arc, one of which is the heavy shadow it casts due to the fact that the lamp burns with a very short arc, the upper carbon in the form of a crater and the lower carbon to a point which intercepts the light emitted by the crater of the upper carbon. The heavy side rods necessary cause excessive shadows in two directions. The arc travels around the carbon quite rapidly and, being open, is affected seriously by wind and weather, causing a very unsteady and flickering arc and an uneven and poor diffusion of light.

These lamps have to be visited each day for trimming, which is a large expense that is indirectly borne by the municipality.

To meet the demand for cheaper light the "Half Arc" of twelve hundred nominal candle power was introduced. This, however, had the same objectionable features as the full arc, except the glare in the vicinity of the pole was less aggravating.

The inclosed arc lamp is by far superior to the open arc. In it we have a long arc burning in an enclosed globe in which the air is practically free from oxygen. Although most of the light comes from the crater, still a greater percentage is emitted directly by the arc itself owing to its length.

A large portion of the crater's area is visible over a wider vertical angle and the crater is not so concave as in the open arc; hence less concentration and better distribution of light. The principal variation in the light of an inclosed lamp is caused by the travel of the arc over the flat carbon ends.

This variation can be greatly reduced by the use of an opal enclosing globe which becomes luminous all over and obliterates the shadows which would otherwise be cast by the side rods and lower carbons. Even if we used a clear enclosing globe, the shadows are not so strong in contrast as those of the open arc.

There are two classes of enclosed arc lamps, the direct current and the alternating current. When consuming approximately the same watts at the arc the direct current lamp gives slightly more light than the

alternating current both at the lamp and at the light-intersecting point. The difference, however, is slight and is made up by the better distribution of light to be obtained from the alternating current lamps.

It seems to me that the arguments to be found against the open arc lamp are so strong that it is practically eliminated from consideration by any municipality.

While the direct current enclosed arc lamp emits as much light when consuming the same energy as an alternating current lamp, it requires special generating apparatus which is more expensive than the static apparatus necessary for alternating current lamps and there seems to be little excuse for the installation of such a system at the present day.

Alternating current arc lamps may be had that consume any amount of energy from two hundred eighty-five watts to four hundred and eighty-five watts. The lamp chosen will determine the number necessary in a given distance to light properly.

The number of lamps per mile is governed to a great extent by established location, distance between cross streets, length of blocks and other local conditions. Nevertheless, the greater economy and superior illuminating value of small units is well worthy of consideration.

While with a constant arc voltage, the candle power of an arc lamp increases in proportion somewhat more rapidly than the watts, the lighting distance increases only as the square root of the candle power. It is therefore more economical to work with the lower efficiency arc at a short distance than with the higher efficiency arc at a long distance.

There are four standard units of the alternating current enclosed lamp, viz.: 485 (7.5 amperes), 425 (6.6 amperes), 350 (5.4 amperes) and 285 (4.4 amperes) watts per lamp. The distance to which these units will project a given illumination is 247, 227, 197 and 178 feet, respectively, with a corresponding watt consumption per mile of 5180, 4940, 4690 and 4235, thus showing in favor of the 4.4 ampere lamp a saving of 945 watts per mile over the 7.5 ampere lamp for the same illumination midway between lamps and with the additional advantage of confining their more brightly illuminated areas along the street.

By maintaining 5180 watts we can run slightly over eighteen 285 watt lamps per mile, but while the small unit will light a greater distance per watt, the advantage is somewhat offset by the increased initial cost and maintenance per mile for the additional small units required.

There has been developed in the last year a lamp that is a wonderful improvement over all type of lamps; it is the luminous arc lamp made by the General Electric Co. It is a direct current lamp of four amperes operated by either the Brush machine or Rectifier Tubes. This lamp operates with about three hundred to three hundred and twenty watts at the terminals and gives an effective illumination of about 30 per cent. greater than the enclosed arc, either series, direct or series alternating. Tests have shown that the direct current arc with 480 watts at the ter-

minals gives a certain illumination at 257 feet, the series alternating enclosed arc with the same energy gives the same illumination at 247 feet while the luminous arc gives the same intensity at a distance of 325 feet. It is absolutely steady and casts no shadow. It has a life of 180 hours as against 80 hours for the other lamps and requires only one electrode at each trimming.

Many cities who are installing new systems have chosen the luminous arc lamps and the writer is installing them in Watertown, N. Y. The choice of globes for the enclosed arc lamps is a matter of some importance. Tests show that the opal enclosing and clear outer globe is a combination that gives the best results; the explanation being that the strongest light thrown from the arc at an angle of 35 to 40 degrees below the horizontal while it brilliantly illuminates the lower portion of the globe which diffuses the light upwardly and compensates for the loss by absorption through the useful angles.

A 6.6 ampere series alternating lamp has under test projected light through various combinations of globes as follows:

Opal enclosing and clear outer.....227 feet.
Clear enclosing V and clear outer.....207.9 feet.
Clear enclosing and Opal outer.....192.4 feet.
Opal enclosing and Opal outer.....188.5 feet

To advise in the abstract concerning the hanging of arc lamps is almost impossible as local condition practically force the use of one or the other of the various ways. Mast arms and cross suspension are generally used where the wires are overhead.

Pole top fixtures are used occasionally in public squares but are not very desirable where any other form of support can be used.

Where the system is underground, ornamental poles are desirable. The distance above the ground arc lamps should be hung must be determined for each individual lamp. For open arcs the distance should be about thirty feet, for series direct current enclosed lamps twenty-two feet, for series alternating enclosed lamps eighteen to twenty feet, for the luminous arc about thirty feet. However, in heavily shaded streets it has been found desirable to hang lamps as low as twelve feet from the ground.

Contracts for arc lighting should never be drawn on the basis of a nominal candle power. They should clearly specify the kind of arc to be installed, the amount of energy to be taken in each arc and the kind of shades to be used. The nature of the fixture should be specifically designated whether pole top, brackets, mast-arms or cross suspension as well as the height above the street each lamp should be hung. These and the location of the lamps should be designated by some one familiar with the practical street lighting with due consideration for each peculiar local condition. The hours of lighting should be distinctly stated with rebates for failure to provide continuous light

within these hours. Such rebates should be merely nominal for deficiencies up to one or two per cent. of the total hours of lighting and punitive on an increasing scale for greater deficiencies. With all these things definitely stated in the contract and carried out by the contractor there only remains to deliver to each lamp the requisite quantity of current to insure good street lighting.

THE PRESIDENT: We have passed two or three papers of the last day or two on account of the changes regarding the use of the stereoptican, and I will call for those papers now, and hear such as are present; I believe the first is the report of the Committee on Taxation and Assessment, by Mr. Wm. S. Crandall.

MR. CRANDALL: Mr. Chairman, the report of the Committee will be exceedingly brief on account of the papers that have been read by title the other evening, and I wish to read the second paper by title also.

CONSTITUTIONAL RESTRAINTS UPON THE TAXING POWER.

BY LAWSON PURDY OF NEW YORK CITY.

Two-thirds of our states are tied fast by their constitutions to what is called the General Property Tax. They are bound to assess all property at its true value and tax it at the same rate and in the same manner regardless of its character.

These constitutional restraints were not adopted early in our history, but generally have their origin later than 1840. The revenue provisions of the constitutions of Illinois and Ohio are typical and have been extensively copied.

The provision of the Illinois Constitution was first adopted in 1878 and is as follows: "The general assembly shall provide such revenue as may be needful by levying a tax, by valuation, so that every person and corporation shall pay a tax in proportion to the value of his, her, or its property."

The Ohio Constitution adopted in 1851 is as follows: "Laws shall be passed taxing by a uniform rule all moneys, credits, investments in bonds, stocks, joint stock companies or otherwise; and also all real and personal property according to its true value in money."

The State of Minnesota adopted a constitution about 1858 and imitated Ohio; Idaho followed the Illinois precedent.

Progressive men in many of these constitution-ridden states are now actively engaged in an endeavor to release their states from the dead hand of the Fundamental Law.

THE GENERAL PROPERTY TAX.

Men with a practical knowledge of the workings of the general property tax condemn it unreservedly. The problem now is how to get rid of it. Many, however, who see that the general property tax is impracticable, unequal and unjust and oppose it on practical grounds, fail to condemn the theory on which it is based, and sometimes give assent to the justice of the theory. In this form the argument lacks the moral force to appeal to the mass of men who happily are more moved by moral than material issues.

The theory of the general property tax is far worse than the practice, for the practice is always tempered by the steadfast opposition of the inherent nature of men and things, and by mercy, ignorance and perjury. The theory seems to be that "Taxation should be equal and must be equally imposed on all property." This theory is not so old as the system it attempts to justify. Apparently it has been evolved from Adam Smith's statement that everyone should contribute to the state in proportion to the benefit he receives. Unfortunately he failed to lay down any just measure of benefits, and said that ability to pay taxes is the easiest ascertainable measure. Someone in this country conceived the idea that the aggragate value of a man's possessions measures his ability to pay, hence all property must be taxed equally.

A very brief examination of the attempt to tax all property equally will prove that it does not conform in the least to either of the canons of Adam Smith, namely, that taxes should be in proportion to benefits received or ability to pay. The equal taxation theory pre-supposes a community so isolated that population and capital shall be immovable, conditions which never did and never can exist. In fact men can move about and take their capital with them and can send it away to be used elsewhere for their benefit. Under these actual and natural conditions taxes on some kinds of property are paid by the owner, on others by the user, and in other cases the market value of the property is so decreased that the tax is no burden to the present owner. So long as the tax does not increase, the amount of the rate is immaterial to the purchaser of improved real estate, because the tax reduces the purchase price. The purchaser buys a net income of 5 per cent. or more, and, conditions remaining the same, gets what he paid for. Another man buys 5 per cent. bonds at par, the price being fixed by world markets. The tax is two per cent., and his net income only 3 per cent. The same principle applies to the tax on the stock of foreign corporations. Capital invested in manufacturing or stock-raising in competition with untaxed capital yields a poor return. The tax on machinery, goods and credits, or on live stock, cuts down the profits. Capital invested in retailing goods with which there is no outside competition, can make an average profit by adding the tax to the price of the goods.

The shifting and incidence of taxation are controlled by immutable natural law, which the equal taxation theory entirely ignores. The more perfectly the theory is applied the more unjust is the result. The Supreme Court of the United States has taken judicial notice of the injustice of taxing everything alike, saying: "This court has repeatedly laid down the doctrine that diversity of taxation, both with respect to the amount imposed and the various species of property selected either for bearing its burdens or for being exempt from them, is not inconsistent with a perfect uniformity and equality of taxation in the proper sense of those terms; and that a system which imposes the same tax upon every species of property, irrespective of its nature, condition, or class, will be destructive of the principle of uniformity and equality in taxation and of a just administration of property to its burdens." (Pacific Express Co. v. Seibert, 142 U. S. 451.)

THE TAXATION OF INTANGIBLE PROPERTY.

No one is willing to uphold a tax avowedly unjust or unequally imposed upon property of any particular class. Those only who have not given careful thought to the incidence of the tax approve a tax on intangible personal property. When a state attempts to tax intangible personal property one of two results is inevitable. If the tax is equally imposed, without any exemption, on all evidences of debt of a class over which the state can exercise jurisdiction as to the entire class, the rate of interest is increased by the amount of the tax and the burden of the tax falls upon the debtors, a result neither anticipated nor desired, and essentially unjust. The mortgage tax law of California and the tax on corporate bonds in Pennsylvania are illustrations. If the tax is imposed on evidences of debt or open accounts, the value of which is determined by conditions outside the state jurisdiction, or on which form the nature of the case the tax cannot be imposed with absolute certainty, the tax cannot be shifted by the lender, and conditions arise under which more than half the income may be confiscated—a result which must be revolting to any enlightened sense of justice. Illustrations of this second class of cases are so common in every state cursed by the general property tax that all are familiar with them.

THE FARMERS' INTEREST.

It is often assumed that the taxation of personal property under the general property tax is in the interest of the farmer. So far as intangible property is concerned the tax is theoretically indefensible, and the practical results show that the farmer has nothing to gain from such taxation. It is frequently stated that the farmer's property chiefly consists of land, and that improvements on land and movable property form a smaller proportion of his property than of the property situated in cities. The assertion is contrary to common observation of social growth, and to the facts disclosed by assessment rolls.

When a country is first settled land has no value. The property of the first settlers consists of such movable things as they bring with them. The next property to appear consists of improvements made upon the land, such as houses, barns, fences, and the improvement of the land for cultivation. Such communities still exist, and the value of their land is a small part of their aggregate property. As the density of population increases the value of land relatively increases, until we reach the condition of the City of New York, where in the sections in which land is most valuable improvements are not worth more than half as much as the land. There is one residence section of New York, less than three square miles in area, in which the land value alone exclusive of the buildings, exceeds in value the assessed value of all the real estate, buildings included, in the whole State of Kentucky. In two other sections in the business district, which does not include the financial center, the value of the land alone exceeds the entire real estate assessment of the State of Missouri. These two sections are less than six square miles in area. The assessed value of the land exclusive of improvements, is $919,000,000, and the real estate assessment is $1,291,000,000.

The value of movable personal property bears some relation to the value of buildings, and it is obvious that as land grows more valuable the movable property on it is worth less in proportion. These deductions are all emphasized by the assessment rolls of states which have the general property tax. In Ohio, Illinois, Kentucky and Missouri, personal property is a larger share of the property taxed in the country than in the cities. The Missouri assessment rolls for 1903, the latest I could obtain, confirm this statement. There are only four large cities in the state, and the effect of the personal property taxation is shown by a comparison between the city, counties and the remainder of the state, and between the City of St. Louis and one of the rural counties. In the four city counties personal property amounts to less than 20 per cent. of the total assessed value of real and personal property, while in the remainder of the state it amounts to 29 per cent. In St. Louis personal property amounts to 20 per cent. and in the rural county of Camden it amounts to 35 per cent. of the total. Camden County is an exceedingly good illustration of the way the taxation of personal property affects the farmers. The assessed value of the property in the county is $2,003.040. Of this amount 35 per cent is personal property, and two-thirds of this personal property by value consists of live stock; that is over one-fifth of the entire taxable value of Camden County is live stock. Under a severe listing system it is absolutely impossible for farmers to avoid paying taxes on their live stock, and the result is that farmers, as a class, pay vastly more in taxes than they ought to pay. The effect of this upon the cities is indirect, but none the less extremely harmful. The farming industry is discouraged, and country boys are driven to the cities, where their competition reduces the wages of those who are city born.

Such being the facts it should be easy to convince the rural population that they have everything to gain and nothing to lose by new methods of raising state revenue.

A PRACTICAL PROGRAM.

While the primary object must be to amend these constitutions, it may be desirable and even necessary to present a practical plan for action after constitutional restraints are removed.

Many years ago it was recognized by students that the revenue systems of the state and local governing bodies must in some way be divorced. The arguments for the change were so compelling that the attempt has been made in many states, and in a few has already succeeded. At the beginning of this movement there seemed to be only one way to accomplish the result, and that was by providing revenue for the state by special taxes on selected subjects of taxation and levying these taxes at unvarying rates. The serious objections to this plan were foreseen by few, but they are especially forced upon our attention by the experience of New York.

For over twenty years the State of New York has been attempting to separate the sources of state and local revenue, and up to twelve years ago had not progressed very far. In 1894 the state still relied mainly for its revenue upon the general property tax; that is, upon the tax laid upon real and personal property as assessed by local officials, the tax being levied by local officials and collected by them, and the proportion required by the state being turned over to the state by the county treasurers. In this manner the state raised about $9.000,000 in that year, and the revenue from special taxes levied for its own benefit only amounted to about $4,000,000, the total revenue of the state being approximately $13,000,000. This year the state's revenue will be about $27,000,000, all of it derived from special taxes, there being no tax for state purposes included in the general property tax.

In the struggle to obtain exclusive revenue for the state great changes have been made, many of them far from desirable. The taxes for state purposes upon various corporations have been increased since '94 from $2,000,000 to $7,000,000. A liquor license law has been enacted, which has increased the revenue from this source, and half of it has been given to the state; the state's half now amounts to over $9,000,000. By changes in the Inheritance Tax and through the increase in wealth and population, the receipts from this tax have been increased from $2,000,000 to nearly $5,000,000; last year it was over $5,000,000. In 1905 a tax was imposed on sales of stock which yielded over $6,000,000.

The activities of the state have been enlarged, and in twelve years its revenue has more than doubled. The inevitable tendency when taxes are laid at unvarying rates is to spend all the proceeds, and when more money is needed to seek out some new source of revenue. There is thus little check to extravagance, and subjects of taxation are selected

and methods of taxation devised which are undesirable and hurtful to the prosperity of the state. In spite of all this, however, the end was a desirable one, and it is only the means which are open to criticism.

A FAIR METHOD OF RAISING STATE REVENUE.

Six years ago the New York Tax Reform Association devised a plan for raising state revenue which at the same time would obviate the necessity for levying a state tax on all property as assessed by local officials, or of imposing any more special taxes on selected subjects. By this plan so much revenue as the state should require in excess of the revenue produced by the special taxes in force would be apportioned to the several counties of the state in proportion to the revenue raised by each county and by all the taxing districts within it. Then the counties were to be left free to raise that amount of state revenue under the general laws of the state by taxing only such subjects as they should select. After a consideration of the matter for six months the Committee on Taxation of the New York Chamber of Commerce unanimously reported in favor of this plan, and the report was unanimously approved by the Chamber. In their report the committee pointed out that the tendency of the legislature to derive revenue from special taxes for state purposes, and to rely on this revenue exclusively, would take away from taxpayers that interest in state expenditure and state taxation which is present when taxation is direct; that it would tend to promote extravagance; that it would throw the burden of state expenditures upon the urban political divisions; that it would deprive the political divisions of the state of subjects of taxation. It was also shown at that time that the various business interests of the state would always be in danger of being singled out as subjects for special taxation for the increasing needs of the state.

The plan of apportionment endorsed by the Chamber of Commerce was not adopted, and all these prophecies have been fulfilled.

Professor Edwin R. A. Seligman of Columbia University, who is regarded as the leading authority on taxation in the United States and who for many years has advocated the divorce of state from local taxation and the raising of a large part of the revenue for state purposes by special taxes, wrote a review of recent tax legislation in New York for the Review of Reviews of July, 1905. After pointing out that a system of state revenue which depended exclusively on special taxes is inelastic and objectionable from other points of view, he said:

"This is an unfortunate state of affairs, and will, if persisted in, lead to ultimate disaster. Every modern system of taxation must possess the element of elasticity. There is one scheme that has been suggested by the New York Tax Reform Association in New York and Ohio, and which has been put in partial operation in the State of Oregon, which would bring about this result. This is a method of apportioning the state tax and granting local option in determining the subjects of local

taxation. It rests upon the idea that the necessary revenues may be derived by making each locality contribute to the state revenues in proportion to its own expenditures. The scheme possesses four advantages: First it would provide elasticity, as did the old system; second, it would tend to keep down state expenditures, because each locality would be interested in the control of state finance, an interest which is now fast being lost; third, it would tend to keep down local expenditures; and fourth, it would enable each locality to raise its revenue in any way that seemed best to it, and would put a stop to the conflicts between country and city. If the rural districts desired to maintain the personal property tax, they could do so; if the larger cities desired to substitute something else, they would be equally free to follow their bent."

The Local Option or Home Rule bill proposed by the New York Tax Reform Association was carefully drafted to avoid conflicting laws. It provided simply that the appropriate authorities of any county might exempt from taxation any class of property. It did not permit the separate counties to make any new law for the taxation of any property; all they could do was to remove a class of property from the taxing power.

Anyone familiar with the actual practice of assessors in any state, could readily foresee what would happen if such power of exemption were granted to local homogeneous communities, for in every state to-day such local option is to a large extent exercised in fact, without the sanction of law. Instances of this will probably occur to everyone. I knew of a case in the State of New York where the assessors by a formal vote resolved not to assess any personal property at all. In some rural counties live stock is never assessed. I was told the other day that in Chicago there is practically no attempt to assess the shares of stock of foreign corporations in the hands of individual holders. The outrage of such an assessment is recognized and the law deliberately nullified. With legal option there would soon be legal exemption of classes of property which to-day are seldom assessed, and gradually all intangible property would be exempted and such other exemptions of movable property would be made as experience should demonstrate would be for the welfare of the community.

CONSTITUTIONAL AMENDMENT.

The constitutions of most of the eastern states, which were made early in the history of the country, are what constitutions ought to be—declarations of general principles with no specific provisions for carrying out those principles. The constitutions of New York and Connecticut are silent as to taxation. The constitutions of New Jersey and Pennsylvania impose but slight restraints. That of Pennsylvania provides for classification, and Pennsylvania alone of all the states has never had a general property tax. These states have been able to change, improve and adjust their tax systems to modern conditions, and in many respects are far in advance of states like Missouri and Ohio which are tied by constitutional restraints.

Fear is sometimes expressed that the abolition of restraint upon the legislature may result in bad legislation. There seems to be little ground for such a fear, for no worse system of taxation can be devised than that now in force where the constitution requires the equal taxation of all property. The constitution of the United States gives all the protection a constitution can well afford.

The amendment of a constitution is, however, a political and practical as well as a theoretical proposition. Such an amendment should be proposed in each state as the people with their present knowledge are likely to ratify. However that amendment may be framed. whether present restraints are stricken out or new powers are inserted, there are two essentials. First, that the state may be able to obtain its revenue without relying upon a tax levied on all property as assessed by local officials; second, that some measure of Home Rule shall be granted to the counties of the state.

THE EXPERIENCE OF EASTERN STATES.

Some of the eastern states are fortunate in having escaped from the constitution mania. New York, Connecticut, New Jersey and Pennsylvania in spite of many and gross defects in their taxing system, are every one of them vastly better off than states constitutionally restricted. In New York debts may be deducted from the aggregate value of personal property. This makes the personal property tax a far more elastic system than when debts can only be deducted from credits, or when they cannot be deducted at all. By a law enacted this year all new mortgages are exempt from taxation entirely after paying an initial tax of one-half of one per cent. at the time of record. Banks and trust companies are assessed at their book value so that the assessment is uniform. The tax is also uniform, being at the rate of one per cent. throughout the state.

In Connecticut debts secured by mortgage of real estate in Connecticut are exempt from taxation. Railroads and street railways are taxed one per cent. on their gross value. ascertained by a comparatively simple mathematical rule. New Jersey has much to learn, and is going through the throes of a tax agitation, but for many years debts secured by a mortgage of real or personal property have been exempt from taxation.

In Pennsylvania mortgages and all credits are taxable only at the rate of four mills, and the personal property employed in manufacturing is entirely exempt from taxation. Taxes are not imposed on merchandise of any kind directly, but instead there are mercantile license taxes graded in proportion to the sales, at moderate rates. Banks are uniformly assessed in a similar manner to those of New York, and the extraordinary growth and prosperity of Pennsylvania bears witness to the wisdom of the tax system which they have always enjoyed.

CONCLUSION.

By constitutional restraints we lose a great part of the superb advantages we possess in our Federal system. The bond of union between the states leaves them free to develop each in its own way. If this development should continue unrestrained by state constitutions every state could learn something from the experience of every other state. The state with a good tax system would be more prosperous than its neighbors and would draw from them both wealth and population. The backward states in time would almost be forced to adopt the better ways of the wise and prosperous. So by this healthy rivalry in well-doing progress will be steady and no bounds can be set to its advance.

THE PRESIDENT: If there is no objection the paper will be received and spread upon the record.

THE PRESIDENT: The next paper is "Street Railway Situation in the City of Detroit," by Mr. Robert K. Davis.

MR. DAVIS: As there are a number of other papers to be read, I do not know but what it would be a better plan to skip some. Detroit presents at this time a very unique situation as to matters of the street railway plans, and I therefore will read only the main points of the paper, and leave the remainder to be printed.

THE STREET RAILWAY SITUATION IN DETROIT, MICH.

BY ROBERT K. DAVIS, OF DETROIT.

The street railway situation in Detroit presents at this time an interesting subject for consideration. To begin at its beginning, the controversy between the municipality and the street railway company began in 1891 in connection with a strike on the part of the operatives of the railway system for higher wages. During that industrial dispute, considerable bitterness was engendered between the citizens and the owners of the street railway lines, which were then operated by animal power. The discussion waxed warm and continued after the settlement of the industrial dispute. Upon the one side, the late Governor Pingree of Michigan, then the Mayor of the city, made the contention that the franchises of the street railway company had already expired, his view being that the grant made in 1879 and extending the life of all street railway franchises in the city was defective. An issue was framed upon this point and carried through the state and federal courts, with the result that the court of last resort decided that the grant made in 1879 was not defective, as claimed, but continued during its full period until 1909. The difference between the street railway company and the

city has been, since that time, made the subject matter of discussion—some of it intelligent and honest, and some of it selfish and political—between the people of the city and the company, with the result that as the years have elapsed, the city and the company are now facing the prospect of the expiration of certain franchises in 1909.

The contention of Mayor Pingree and his associates was that the street railway company was charging too great a rate of fare, and he and they set themselves out to procure for the people and the city a three-cent fare, which was afterwards modified to the proposition of eight tickets for a quarter.

Failing in securing access to the streets upon which the franchises had been extended for thirty years from 1879 and thereby making new conditions with the street railway company which would result in something permitting the adoption of the eight for a quarter rate, a number of moves were made with various sets of capitalists, having for their object the purchase of the street railway properties by new capital which would grant in one form or another, the much desired reduced rates of fare. These efforts all failed of their object, although, at various times, each of them seemed upon the eve of completion.

The City of Detroit is peculiarly laid out for the purpose of street railway transportation. Modeled originally upon the design of the City of Washington, the system of radial streets provided in the plan of the national capital by L'Enfant, the French engineer, was put into the plan of the city after the destructive fire of 1805, the result being that from the center of the city, main avenues radiate in all directions, thereby rendering ready and direct access to the various sections of the City.

Imposed upon this radial system is the ordinary rectangular system of streets and avenues which is familiar in the planning of most American cities.

These radial streets were all occupied by the original street railway company, and under the franchises existing at the time, of the beginning of the Pingree agitation, a single fare was charged upon the lines running upon these streets and having their termini in the center of the city, so that to cross the city from east to west or from west to east, required the use of two lines and the payment of two fares.

A modification of these franchise privileges was made voluntarily by the street railway company upon the introduction of the electric system of transportation to the extent that lines terminating in the center of the city were consolidated in their operation and made into fewer routes crossing the city from east to west, a single fare being required from one point to another point upon these routes. Certain transfer privileges were conceded voluntarily, but these concessions were not sufficient to satisfy the demands of the public at the time.

In 1895 Messrs. Everett and Moore, who have since become famous as large operators in street railway properties, appeared upon the scene in Detroit and procured a franchise from the city, covering some sixty

miles of streets, and proceeded forthwith to construct a street railway system.

From the nature of the situation, the routes thus authorized could not be direct, but were obliged to follow the streets forming the rectangular blocks and squares rather than the radial streets, which furnished the most direct routes to the center of the city, these latter being already occupied by the first street railway system. However, a system was built which developed certain portions of the city not then enjoying street railway facilities, and was put into operation upon the basis of an eight for a quarter rate during the hours of the day time and up to eight o'clock at night, and six for a quarter rate from eight o'clock at night until five o'clock in the morning, and a single five cent cash fare. Opposed to these rates was a straight five cent cash fare upon the lines of the already existing companies, modified by an eight for a quarter workingmen's ticket, available during two hours of the day, one in the morning and one in the evening.

The new corporation continued to give service independently for about four years, after which time it was absorbed into the Detroit United Railway, a new corporation composed of the owners of both the old and the new systems, and the two came to be operated under a single management and with such economies as grew out of consolidation of the expense of superintendence and the production of power; but so far as the eight for a quarter system and the original lines were concerned, they continued to be operated as separate properties, with separate rates of fare.

Detroit has 187 miles of railroad within its present city limits. Of these, 60 miles are operated under the eight for a quarter system, and the remainder under the five cent fare basis.

The public duties of the original roads included the payment of an annual tax of two per cent. upon their gross receipts, the ordinary taxes upon their real estate for city purposes and taxes which included the assessment of a large valuation representing franchises for state purposes. In addition, these railways are required to make the foundations and maintain the pavements between their tracks, but no portion of the payment outside of the rails. The eight for a quarter system is required to pay no tax upon its gross receipts, and in consideration of the undertaking of its projectors to furnish cheap railway fares to the City of Detroit, it was relieved of the duty of providing foundations and laying and maintaining pavements between its tracks. This contribution toward the operation of the cheap fare lines represented relief from the two per cent. franchise tax upon about $800,000 of earnings per year, and from paving obligations which the Commissioner of Public Works has lately estimated to average $61,000 per year.

As between the eight for a quarter system and the five cent system, no provision is made for transfers for the benefit of patrons who desire to move from a point upon one system to a point upon the other.

The present condition of the street railway question in Detroit is, therefore, briefly as follows:

That two distinct fare systems exist, and that there is no accommodation afforded between these two systems except to such passengers as pay a straight five cent fare, and this accommodation is not a matter of right to all patrons, but of concession by the owners of the properties.

That two distinct sets of provisions exist regarding the public duties of portions of the system with regard to taxes and the maintenance of ways.

That as to the eight for a quarter system, franchises in effect at the present time will continue to apply to the lines of this system until December 4, 1924.

That as to the five cent system, certain of the franchises, being down town portions, will begin to expire in 1909, but not with such completeness that it will be possible to use them as the basis of the new system, beginning in the center of the city and extending to its outside districts. For instance: Certain accommodation made to the eight for a quarter railways when they were being constructed, to avoid duplication of tracks in the down town district, resulted in the occupancy by them of certain stretches of tracks, the franchises for which would have expired in 1909 had there been no interference, but which are now held to be extended to the full life of the Detroit Railway, or eight for a quarter, system's ordinance.

Several mayors of the City of Detroit have applied their genius to the settlement of this question. There has been considerable bitterness engendered in the discussions. Meantime, the present owners of the property have gone ahead, have practically rebuilt the entire system, refurnished it with equipment and maintained an excellent service. Even the most violent opponent of the street railway management will do it the grace to concede that the service rendered to the people of the City of Detroit is adequate and excellent. We who live in that city like to flatter ourselves that in quality and condition of track, that in quality and capacity of cars, in frequence in service, and the speed with which cars are moved, the street railway system in our city is just a little better than that in any other city in the United States. The present managers of the property have not been ungenerous in putting back into it a large portion of its income for its development and maintenance. Within ten years the city has added upwards of 100,000 people to its population. Owing to the friction existing between the railway company and the city government there has been in that period but two miles of additional railway route added to the facilities which existed ten years ago.

With the departure of Mayor Pingree from the office of mayor, and his assumption of that of governor, he was succeeded by the Hon. William C. Maybury, who held office for a period of seven years, and whose policy, while not wavering in the expression of the city's opposition to the railway company's claims, was one that was calculated to

bring about peace rather than engender bitterness between the railway company and its patrons.

Mr. Maybury was succeeded a year and a half ago by the present incumbent of the mayor's office in Detroit, the Hon. George P. Codd, who, immediately upon his assumption of office, proceeded to bring about, if possible, a permanent and lasting peace between the people of the city and the street railway company, serving them upon conditions which would be fair to the people of the City of Detroit and at the same time not unjust to the capital invested in the street railway system.

A series of conferences, covering nearly a year, has recently resulted in the proposal by the mayor to the people of a new franchise, the terms of which have been the subject matter of negotiation between himself and the representatives of the street railway company, and are said by both to represent a final solution of the street railway question in Detroit, when it is considered that a fair return is to be provided for the capital actually required to reproduce the system and to maintain the present scale of wages paid to operatives. This latter, by the way, is the highest rate of wages paid upon any surface line in the United States, being twenty-five cents per hour for both motormen and conductors who have been in the employ of the railway company for more than three years—this group of operatives representing fully 80 per cent of the employees of the system.

The terms of the new ordinance proposed by the Mayor of Detroit and accepted by the railway company, are that all of the franchises of the various lines, some of which expire in 1909, some other in 1912, some others in 1915, and some others between that date and 1924, shall all be extended to the date upon which the franchise rights of the Detroit railway, or eight for a quarter system, will expire under the terms of its ordinance, viz.: December 4, 1924, and that in consideration of the continued permission to do business, the railway company shall accept the following conditions of operation: That for five hours of each day, viz.: from five until eight o'clock in the morning, and from half past four until half past six in the afternoon an industrial ticket fare shall be placed in operation at the rate of ten tickets for 25 cents, or 2½ cents per industrial ticket. That during the remaining hours of the day, a six for a quarter ticket shall be accepted for fare. The single cash fare rate of 5 cents, which seems to be standard upon all the street railways of the country, remains. These fares are to apply to all the lines, and a system of universal transfers from line to line shall be put into operation and maintained. Upon the gross receipts of the entire system, the street railway company shall be required to pay a tax of two per cent per annum into the city treasury as a franchise tax. As to public duties with regard to streets, the railway company shall be required to make and maintain foundations and pavements lying between its tracks and to maintain all pavements for twelve inches outside its tracks.

Furthermore, as the franchises will expire at a uniform date, viz., December 4, 1924, and as upon that date no municipal ownership propo-

sition which might be suggested could be enforced as against the entire street railway system of the city, if that were at any time thought desirable, provisions have been made for the purchase by the city, at the expiration of the period of the franchises now granted, of the entire new system, upon an arbitrated value to be determined by a commission, a portion of which shall be appointed by the street railway proprietors, a portion by the city, and another portion by the local Chancery Court. The arbitrated value shall be the purchase price of the property, and in arriving at it, no acount shall be taken of the value of franchises or of the good will of the business. The arbitrators will be required to determine, as between the city and the railway company, the value of the property then in existence and capable of being taken over by the city as a going concern. It might be added that the new franchise provided for the immediate construction of twenty-three miles of additional track within the City of Detroit, and for the construction from time to time hereafter, as the Common Council may direct, of additional routes, the rights to all of which, under the terms of the new ordinance, will expire at the same time as all of the rest of the property, thus enabling the city, at their expiration, to come into the possession of every yard of street railway track within the city, if such a process shall be deemed desirable.

Ample reservations of police power and of the right to regulate the operation of cars, to alter routes and to provide all manner of other reasonable regulation of the street railway system is reserved in the ordinance to the Common Council.

This whole proposition is now being discussed by the people of the City of Detroit. Practically every member of the city government, regardless of politics, pledged himself, when standing for office, that whatever settlement was made between the street railway company and the city, should not become effective until it had received the final approval of the people as expressed at an election. While such an expression is wholly extra legal and has no binding effect other than a moral one upon the Common Council, the pledges of both the mayor and the members of the council are sufficient to satisfy the people that if they vote against the proposition, it will not be passed, whereas if they vote for it, it will be passed by the members of the council, regardless of their individual views upon the subject.

So far the ordinance has been received with considerable favor. A campaign of education is going on on the subject between the respective candidates for mayor, the present mayor, the proponent of the ordinance, being its most notable defender, while his political opponent, representing opposition to any street railway settlement that may be made at this time, preferring to await the expiration of franchises now nearly expired, before undertaking negotiations upon the subject.

So far the ordinance has received the approval of the leading business men of the city, a distinguished body of citizens having associated themselves into a Citizens' Committee, which has already audited the

books of the street railway company and determined for itself what the cost of carrying passengers in Detroit is and what it should be, and what capital investment would be necessary to reproduce the properties.

In this campaign of education, the street railway company itself has been a considerable factor. It has offered free access to its books of account to any reputable citizen who chooses to investigate its conditions for himself, and it has printed in the public press a series of statements, covering practically the entire range of its business within the limits of the City of Detroit. The figures presented in this series of statements have been verified by the auditor of the Citizens' Committee and found to be absolutely correct.

On the whole, the discussion of the subject among our people is good natured and along the lines of producing the very best results for the city, while, at the same time, respecting the right of the street railway company to earn a fair return for its stockholders and bondholders upon a reasonable investment in the properties.

The City of Detroit is an industrial city which has been growing by leaps and bounds within the last five years. An exceedingly large number of new factories has been added to its industrial capabilities within that time, and their location has been such as to demand the best possible urban street car service. Upwards of 106,000 workingmen are employed in factories in our city and its suburbs. Our working people are very largely home owners. The conditions under which they live are excellent. We have no tenements and no slums. As a rule, persons employed in our industrial establishments live at some distance from the industrial district, and those of us who have given thought and attention to the subject of the street railway transportation in its various aspects as bearing upon the prosperity of our industries, convenience and comfort of our industrial class and the general progress of the city, are inclined to look upon the street railway settlement now before our people as embodying a series of happy comprises, under which, if it be accepted, the street railways will continue to be an instrument of great usefulness in the development of our city, and their owners, we hope, will realize a fair return upon their investment for the risk which they have taken and for the public service which they have accomplished.

Detroit is absolutely fair to capital. It does not take the position of inducing a manufacturer to establish his business in Detroit and wishing him good luck upon his investment, and at the same time, seeking to bring ill-luck to that capital which is invested in public service enterprises. We have tried to be fair in our city to all interests,, and the best argument that we have been sucessful is to be found in our constant growth and our increasing prosperity.

THE PRESIDENT: The next thing in order will be the report of the Nominating Committee.

MR. RUST: Your committee recommends the following nominations for your consideration:

President—M. R. Sherrerd, Newark, N. J.
First Vice-President—James Owen, Montclair, N. J.
Second Vice-President—Julian Kendrick, Birmingham, Ala.
Third Vice-President—Fred Giddings, Atchison, Kas.
Secretary—Geo. W. Tillson, Brooklyn, N. Y.
Treasurer—Lesley V. Christy, Wilmington, Del.
Finance Committee—A. F. Eggers, Newark, N. J.; T. C. Hatton, Wilmington, Del.; R. H. McCormick, Detroit, Mich.

THE PRESIDENT: You have heard the report, what will you do with it. I believe it is in order to present any other names at this time, if any are desired, and I believe the votes must be by ballot.

MR. REIMER: Mr. Chairman, I move that the Secretary be instructed to cast the vote of this convention for the officers as made by the Nominating Committee.

THE PRESIDENT: You have heard the motion, that the Secretary be instructed to cast the vote of the convention for the nominees as read. Any remarks? If not, those in favor of the motion will say "Aye," and those opposed, "No." Carried.

THE SECRETARY: The vote has been cast.

THE PRESIDENT: The next is the report of the Committee on Place of Meeting.

MR. SHERRERD: Your committee having canvassed the several invitations extended to the Society to meet in—Saginaw, Mich.; Columbus, Ohio; Niagara Falls, N. Y.; Norfolk, Va.; Atlantic City, N. J., and Detroit, Mich., take pleasure in recommending the acceptance of the very cordial invitation of Detroit, Mich., and the selection of said city as the place in which to hold the convention for the year 1907.

THE PRESIDENT: You have heard the report, what shall we do with it?

It was moved and seconded that the report of the committee be adopted.

THE PRESIDENT: Is there any remarks? If not, those in favor of the motion will say "Aye," and those opposed, "No."

Carried.

THE PRESIDENT: We will now listen to the report of the Finance Committee.

REPORT OF FINANCE COMMITTEE.

BIRMINGHAM, ALA., October 11, 1906.

Your Finance Committee herewith reports that it has examined the accounts of the Secretary and Treasurer and find them correct.

The balance on hand on September 5, 1905, was $721.92, and the receipts for the year $1,110.65, making a total of $1,832.57. The total disbursements, $1,038.57, leaving a balance on hand of $794.00. All of which is respectfully submitted.

AUGUSTUS F. EGGERS,
FRED GIDDINGS,
Finance Committee.

THE PRESIDENT: I will call for the report of the Committee on Review by Professor Folwell.

MR. FOLWELL: I understand it is the duty of this committee to gather into as brief a space as possible what the country has been doing in the way of improvement societies, and that must necessarily be statistical matter, and I therefore ask that this report be spread upon the minutes. The report consists of two papers, one by myself on The Progress East of the Rockies, and by Mr. T. D. Allin, on The Conditions West of the Rockies. He is not present, but has sent an interesting paper on the conditions of the Pacific coast.

THE PRESIDENT: If there is no objection, the reports will be spread upon the minutes.

REPORT OF THE COMMITTEE ON REVIEW.

BY A. PRESCOTT FOLWELL, CHAIRMAN.

Your Committee on Review have endeavored to collect data from every city in the United States relative to the work done during the

year ending between January 1 and August 1, 1906, Mr. T. D. Allin taking the Pacific Coast, and the chairman the remainder of the country. The results obtained by the former are detailed in a separate accompanying report. The chairman sent requests to the 350 largest cities in his division for reports for the year 1905, and received 56 replies thereto. Annual reports were received from 47, (the city engineer of Springfield, Ohio, took the pains to make up a most neat and tasty typewritten report, as none were printed); and data from 46 of these are given in the accompanying table. In a considerable number of these reports all the desired data were not given and could not be calculated from any statements contained therein. One report from a city of about 25,000 population in northern New York furnished not a single item covered by this table, although it contained alleged reports from every department of the city government is a pamphlet of 132 pages; even when the city engineer's report was examined as a last resource—and the reports of the engineers were generally found to contain more meat than any others—it yielded ten pages of the names of streets on which sidewalk grades had been given, two pages of lists of other miscellaneous work which the engineer had done, and absolutely nothing else; except for the reports of the departments of Education and of Fire, this is the poorest municipal report we have ever received.

One fact brought forcibly to our attention was the delay in publishing the reports of most cities. Few municipal reports are published sooner than six months after the termination of the period to which they refer, and in some cases eighteen months have elapsed before they appeared. One city had had all the matter in the printer's hands for six months except the mayor's report, and that has not been written yet. The value of reports would be increased several hundred per cent if they could reach the citizens within ninety days of the end of the year which they cover.

Too many reports give no data except in terms of dollars and cents. That a given amount has been spent for paving has a certain interest, but this would be increased many fold if the amount and kind of paving obtained for it were stated also.

The most complete reports are almost invariably those of the water departments. (Where no reports concerning the water supply are given in the table the supply is by a private company.) It is probable that this is because of the persistent work done towards obtaining uniform reports in this department. We believe that this Society could do no work more valuable than effecting uniformity and completeness in municipal reports. One effect of this would be the keeping by departments of the records necessary for furnishing these data. Incredible as it may seem to some, there are lighting departments which have no records of the numbers of street lamps in their city; water departments which do not know the number of fire hydrants, miles of mains or even the number of service connections on their system; and numbers of sewer departments have no

records, even approximate, of the numbers of house connections, to say nothing of their locations.

Several cities publish no reports at all. Some feel too poor to do so; but this can hardly be said of all, notably of two of more than 100,000 population each. In fact, an official of one of these writes that for several years the publication of municipal reports of public works has been prevented "through the efforts of contractors and others in this field." Perhaps no stronger argument than this could be offered for the prompt publication of complete data concerning all municipal expenditures.

We hope the Committee on Municipal Data and Statistics will energetically push this matter of municipal reports next year, and the present members of this committee will do all in their power to assist them, as will also, we are confident, the members for the coming year.

REVIEW OF MUNICIPAL WORK ON THE PACIFIC COAST, JULY, 1905, TO JULY, 1906.

BY T. D. ALLIN, MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS.

In a review of the public improvements made by the various municipalities of the Pacific coast, the difficulty confronting the writer is lack of data.

Requests for data were sent to practically every municipality in California, Nevada, Oregon and Washington, and replies were received from only about 30 per cent. of the cities and towns addressed. About 80 per cent. of the southern california municipalities have replied. No replies have been received from the earthquake district of California, the officers there, no doubt, having an abundance of duties of greater importance.

No report has been received from cities in the State of Washington, where several cities have made extensive improvements.

Attached is a tabulation of improvements made by the cities indicated in said tabulation. In addition to the improvements tabulated, the following improvements have been made or are about to be undertaken. All improvements tabulated or mentioned herein apply to the year, July to July, 1905-6, unless otherwise stated.

MONROVIA, CAL.

Water Works—Public. Have estimates on improvements of water works in preparation. Improvements will cost from $85,000 to $100,000. Bonds will no doubt carry.

Lighting Plant—Private. Lights installed, incandescent, 160.

POMONA, CAL.

Water Works—Private. Tunnel developing plant, cost, $2,400.

Lighting Plant—Private. Lights installed, arc, 40; incandescent, 400.

SAN BERNARDINO, CAL.

Water Works—Public. One 16-inch driven well, 1,066 feet deep, seven miles pipe lines, 2-inch, 4-inch and 6-inch diameter. Meters, 25.

Lighting Plant—Private. Lights installed, arc, 21.

RIVERSIDE, CAL.

Water Works—Private.

Lighting Plant—Public. Total lights now installed, arc, 67; incandescent, 32,199.

Garbage Disposal. Deposit-burn and bury on outside grounds.

SAN PEDRO, CAL.

Water Works—Public. Began two and one-half years ago with addition still being made.

Pumping Plant. One million gallons, cost $35,000; two wells, cost $5,000; one covered reservoir, capacity 2,500,000 gallons, cost $10,000; pipe lines, thirteen miles, cost $60,000; meters 45, cost $675.

Lighting Plant—Private. Lights installed, arc, 83; improvements last year, cost $5,000.

Five and one-half miles sewer just begun. Ten car loads crude oil for street work ordered.

ANAHEIM, CAL.

Water Works—Public. One and one-half miles pipe line, cost $1,263; forty-two meters, cost $616.

Lighting Plant—Public. Lights installed, incandescent, 719.

OCEAN PARK, CAL.

Water Works—Private.

Lighting Plant—Private. Lights installed, arc, 5.

Garbage Disposal. Plans for incinerator accepted; construction not yet begun.

SANTA BARBARA, CAL.

Water Works. One public, two private; two public reservoirs, 150,000,000 gallons capacity each. Running tunnel, 20,000 feet through mountain to new source of public supply.

Lighting Plants. Two private.

FRESNO, CAL.

Water Works—Private.

Lighting Plant—Private.

Garbage Disposal. Garbage hauled to yard beyond city limits and burned in pit. New pit dug with teams when old one fills with ashes, etc.

City Hall. Under construction, cost $75,000.

Sewer System. Under construction at cost of $175,000, including sewer farm of 972 acres, costing $30,000.

Oiled Streets. Not successful for wearing surface, but is successful for laying dust.

MODESTO, CAL.

Water Works—Public.

Pumping Plant. One and a half million gallon capacity; wells, 4; tanks, 4, total capacity, 160,000 gallons; pipe lines, 13 miles. Cost $60,000.

Lighting Plant—Public. Auxiliary to water plant. Lights installed, incandescent, 356.

Garbage Disposal. The scavenger hauls the same to the city dumping ground on the outskirts of the city, where it is burned at frequent intervals.

STOCKTON, CAL.

Bond election proposed as follows: Street improvement and repairs, $250,000; city hall, $125,000; fire protection, $60,000; storm water sewers, $35,000; outfall sanitary sewer, $10,000; children's playground, $25,000; Stockton harbor improvements, $15,000; garbage destructor, $20,000; electric lighting plant, $160,000. Total, $700,000.

Ten miles street work proposed for the coming year.

CHICO, CAL.

Water Works—Private.

Lighting Plant—Private.

Street Improvement. Work about to begin on one mile cement gutter and one mile of cement sidewalks. Other street and sanitary improvements to be commenced soon.

OTHER TOWNS IN CALIFORNIA AND OREGON.

Several other towns report no new improvement during the year, only repairs having been made on improvements made, such as water, sewers and streets.

CORVALLIS, OREGON.

Water Works—Public. One reservoir, 300,000 gallons capacity, cost $3,000.

City has just completed gravity water system, with fourteen miles conduit and fourteen miles of distributing system. Source of supply located in the coast mountains. Pipe line capacity 1,000,000 gallons with 75-lb. pressure.

Lighting Plant—Private.

OREGON CITY, OREGON.

Water Works—Public. Pipe lines one and a half miles, cost $8,000.

Lighting Plant—Private. Lights installed, arc, 22.

Garbage Disposal. All garbage hauled to a vacant tract outside of city and burned.

PASADENA, CAL.

In addition to the improvements tabulated there is much of interest that can be stated concerning this rapidly growing little city.

The population is now 25,000, which has increased 3,500 during the past year, with an average increase per year of 3,000 during the past three years.

The city's area is 11.4 square miles, making the expense for street maintenance and lighting very heavy, compared with its population. The tax rate for general purposes is limited to $1.00 per $100 valuation and the bonded indebtedness other than for school purposes is only $322,000.

Contracts have been let for 2.34 miles of asphalt paving and work has been ordered on 3.38 miles more, which when completed will give the city a total of 11.6 miles of asphalt paving. This work is costing from 18½ to 19 cents per square foot for 4-inch cement concrete base, 1-inch binder and 2-inch surface.

The surface of all macadam constructed during the past year has been treated with crude oil. 1.35 miles additional of this class of work has been ordered. From 1¼ to 1½ gallons per square yard of crude oil heavy in asphaltum is applied to the surface and the work complete is costing 7¾ cents per square foot. This class of work has proven very successful in Riverside, Cal., and it is believed that it will prove satisfactory in Pasadena for residence streets.

Contracts have been let and work is being done on fifteen miles of street oiling, the crude oil being applied to the natural surface and ten miles additional of the same class of work has been ordered.

This class of work is done by bringing the natural soil to an even surface and then applying one gallon per yard of crude oil, heavy in asphaltum, then a coat of clean, sharp sand or rock screenings is applied, and then another application of crude oil of about half gallon per yard is made, regulating the quantity of oil applied by the needs to thoroughly wet the sand and yet not leave the surface sloppy. The street is then thoroughly rolled with a six-ton roller. This class of work costs from 1 to 1¼ cents per square foot, and is very satisfactory for outlying residence streets, where traffic is comparatively light.

This last class of work is very general in Southern California towns and cities, and is very satisfactory considering its cost. When condemned, it is generally by persons expecting as enduring work as can be done for many times its cost. The general difficulties encountered with this class of work, and the same also applies to a more limited degree to macadam with oiled surface, is that it does not receive proper maintenance.

After construction it is too often left to take care of itself and the dear public wonders why it does not last equally well with asphaltum or brick pavements.

Oil as applied to country roads is usually of a still cheaper application, only the main thoroughfares being treated in the more thorough way. Except on main thoroughfares the main object being to allay the dust without an attempt to create an asphaltum surface. Many hundreds of miles of country roads in California have been made a pleas-

ure to drive over when were it not for the oil they would be almost beyond endurance on account of dust during our long dry summers.

Another class of oiled streets now being constructed and which promise to be very satisfactory, is constructed by plowing up the street to a depth of six or seven inches and then working the soil to the bottom of the plowing by means of a spiked roller. Oil is added from time to time and the roller run over the same surface hundreds of times, causing the oil to be forced down into the plowing and become incorporated with the earth from bottom to top, with both oil and earth thoroughly tamped by the constant rolling into one compact mass.

In all, approximately three gallons of oil per square yard are used with the cost of the work varying from two to three cents per square foot. About one-quarter mile of this class of work has recently been completed in Pasadena, a part of which work is exposed to heavy teaming, putting it to a very sevęre test. This street is being watched with much interest, as many believe that it cannot long withstand such heavy loads.

In all classes of street oiling the oil is, or should be applied hot 200° F. usually being the temperature. Upon a large percentage of country roads the oil is applied cold on account of the lack of facilities for heating. When hot, the oil penetrates much more quickly, therefore incorporates with the earth or sand more readily and meets with much less complaint from the traveling public for the first few days after it is applied.

In treating city streets one side of the street should be, and usually is, treated at a time, permitting traffic to keep off of the fresh oil until all wetness is absorbed by the natural soil, or the sand application, as the case may be.

For the average residence streets the writer believes the macadam base with oiled surface to be the most nearly ideal streets yet constructed in California. The macadam forms a hard, unyielding base, while the oil, or more truly speaking, the asphaltum, as the oil contains 85 per cent. D grade asphaltum, mixed with sand, forms the carpet or wearing surface, which surface should be as thin as possible to prevent sponginess and yet thick enough to fully protect the macadam. The sand in the asphaltum produces the wearing qualities and the asphaltum provides the cementing qualities which binds the sand together, forming an asphaltum paved street of cheap construction which is noiseless and also dustless with proper maintenance.

Such streets, however, require more attention than asphaltum paved streets and should not be left to take care of themselves.

Water Works—Private. Water is supplied to Pasadena by three private companies, covering separate territories. Water is plentiful for present needs and is excellent in quality. The rates are low and the entire domestic service is metered.

One company has just completed a seven million gallon cement-lined reservoir. New pipe lines and meters are being added to keep up with

the growth of the city. More extensive improvements would be made were negotiations to sell to the city entirely abandoned.

In March, 1905, Pasadena voted $931,250 for the purpose of purchasing the three water plants and for extensions. Antagonistic city officials were elected a week later. Technical difficulties arose. Suits were brought but court decisions so far have been favorable to the transfer of the plants to the city. When the city will acquire the plants is problematic, as the companies are no longer under legal obligation to sell even should the present administration change its attitude, which is not likely, and endeavor to purchase.

The people are strongly in favor of acquiring the existing plants, but are resigned to the necessity of awaiting the advent of a new administration with the additional delays incident to new negotiations with the water companies.

Fire Protection. The city voted $75,000 in May last for fire protection, including the purchase of three lots and erecting thereon three fire houses, enlarging the present houses and for equipments.

Lighting Plant—Private. Some eight months ago a dispute arose between the officers of the private lighting plant and the city council, when the city officials claimed the company was not furnishing the quantity of electrical energy for which it was being charged. The dispute went so far that the city called a bond election to vote $125,000 to establish a municipal plant, which carried. Soon thereafter the lighting company claimed a defect in the proceedings and got an injunction to prevent the sale of the bonds. The matter is still in court. The city determined to have a plant of its own, raised the tax levy 18 cents per $100 ($30,000,000 assessed valuation) and is going ahead with the municipal plant in as far as the money so raised will go.

Garbage Disposal. The garbage is hauled by private parties onto vacant lands and burned, a method becoming entirely unsatisfactory. The city owns land for the purpose and an incinerator will no doubt be erected in the near future.

Public Schools. One hundred thousand dollars was voted in the early summer for more grounds and school buildings. Four new buildings are being constructed, ranging from four to twelve rooms each, in addition to the enlargement of other buildings.

LOS ANGELES, CAL.

Los Angeles is a city of remarkable growth, its population having been increased fully 35,000 during the past year, with a growth close to 100,000 during the past three years.

The water plant is owned by the city, but electric lights and gas are supplied by private companies.

The greatest municipal undertaking during the past year has been the decision to go to the Owens River, in Inyo County, California, for an additional water supply.

The conduit for conducting the water to the city will be approximately 250 miles in length and will cost approximately $27,000,000, which, together with impounding reservoirs at the headwaters of the Owens River and other expenses will bring the final cost to approximately $32,000,000.

Such a bold undertaking had never before been entered upon for a public water supply by a city of the size of Los Angeles, but the water was necessary and could not be had in adequate quantity at nearer points and at a less expense. The people quickly recognized the undertaking as a necessity and entered upon it with the same cool, deliberate enthusiasm that they would enter upon any other business undertaking which they believed would repay them many fold upon their investment.

In the first bond election for $1,500,000 for the purpose of acquiring water rights and beginning the work, the vote was 14 to 1 in favor of the bonds, which clearly showed the united determination of the people to provide an abundant water supply for the City of Los Angeles.

Both preliminary and location surveys are now being made for the conduit, which will probably be of reinforced concrete, about 12 feet wide at the bottom and 28 feet wide at the top, from 8 to 10 feet in depth and covered.

Twenty-five thousand miners' inches are available, which is equivalent to 325,000,000 gallons per day, and is eight and one-half times the quantity of water now being used by the city. The conduit will be a gravity line throughout, over valleys and desert and through mountains, with an opportunity to develop fully 80,000 horse power along its line.

During the year ending November 30, 1905, the city laid 41.23 miles of the pipe varying from 4 to 24 inches in diameter, made 6,608 service taps and added 5,347 meters. At that date there was a total of 46,160 service taps and 8,832 meters. At the present date some 13,000 meters are in service.

Without meters the city was using 300 gallons per capita, but when 8,832 meters had been installed its per capita was reduced to 190 gallons.

No doubt the most interesting and important water case ever tried in the arid West was the case carried on during the past year by the city against the San Fernando ranchers. The Los Angeles River, from which the city has taken its water from the city's very beginning, has its origin from the seepage through the valley gravels along the lower rim of the San Fernando Valley. Until a few years ago the valley was used almost exclusively for grain raising. But few wells were in the valley and the water from these few wells was used only for domestic purposes at the few ranch headquarters scattered over the valley.

A few years ago, on account of the growth of Los Angeles, the lands nearest the city became valuable for truck farming and for the raising of alfalfa, crops requiring a large quantity of water for irrigation.

The ranchers, believing that they were the owners of any water that they could obtain from wells on their own lands, sank wells and put

in pumping plants. As the number of wells and the quantity of water taken therefrom increased the city's river supply began to decrease proportionately with the quantity of water taken from the wells.

It was soon realized by the city that, with a rapidly increasing population, its principal water supply, made use of for more than one hundred years, was rapidly decreasing, and unless its use in the San Fernando Valley could be controlled, the city river supply would soon be depleted.

A year ago there were practically 500 wells in the valley, with new wells and pumping plants rapidly increasing in number, from some of which, when in use, more than 100 miners' inches of water was being taken. From all indications, unless prevented, a few more years would see thousands of wells in the valley and the water plane lowered below the channel of the Los Angeles River.

The city brought suit to prevent the ranchers from taking water from the wells for irrigating purposes. The case was bitterly contested by both sides with the best attorneys and engineers on the Pacific coast taking part. The city won the case in the Superior Court, but the case is now in the higher court.

Storm Sewers. The city is just completing twelve miles of storm sewers, varying in size from nine inches to seven feet. The smaller sewers are of vitrified pipe, but the larger diameters are of either brick or cement concrete. Both brick and concrete sewers are lined on the flow quadrant with vitrified brick. A bond issue of one-half million dollars has been expended, and another expenditure of a larger amount is badly needed for like purposes.

Sanitary Sewers. The city is now constructiong an outfall sewer to the ocean, which is only about sixty per cent. completed. Much delay and annoyance is being caused by bad ground and rebellious contractors. The contractors have thrown up the job and the city is now advertising for bids to complete the work, which completion will require about one year.

The old outfall to the ocean is entirely inadequate for the city's needs, and until the new outfall is completed the city cannot push the the construction of city sewers, which are badly needed.

It is the writer's belief that no sewage should be wasted in the arid West, where water is so valuable. A safety valve to a steam boiler is necessary, but every pound of steam allowed to escape through the valve is a waste.

Just so with the Los Angeles outfall sewer to the ocean, it is a safety valve, but every gallon of sewage passing through it to the ocean is a waste of the city's most valuable asset. A part of the sewage is now used for irrigation, and as plants for sewage purification become more fully perfected, no doubt a very large part and perhaps all of the Los Angeles sewage will be used for irrigation on the arid lands between the city and the sea.

TABULATION OF STREET IMPROVEMENTS ON PACIFIC COAST, JULY 1, 1905, TO JULY 1, 1906

NAME	Street Grading Miles	Sidewalk—in Miles			Curb—in Miles				Gutter—in Miles			Paving—in Square Yards		Oiled Streets Miles	Sewer—in Miles		Sewer—Flush Tanks			REMARKS
		Cement	Stone	Wooden	Cement	Granite	Wooden	Cobblestone	Cement	Asphalt	Cobblestone	Asphalt	Macadam		Outfall	Laterals	Miller-Porter	Walker	Other Kinds	
Los Angeles...Cal.	40.00	75.00	....	....	80.00	Including Granite			.....	....	....	.....	.....	35.00	7.00	14.00	50	..	..	Gutters, 30 Miles Cement & Cobblestone Paving, 6 Miles Asphalt, Br'k, M'c'd'm
Pasadena..... "	22.00	30.00	...	....	38.00	.....	.....	.....	38.00	....	....	32,000	23,500	20.00	....	2.80	20	..	..	....
South Pasadena "	7.30	8 00	....	....	8.00	.....	.....	.....	4 50	....	....	.....	.....	20.00	....	.....	..	..	..	.....
Alhambra..... "	6.00	12 50	....	....	12.50	.....	.....	.....	12 50	....	....	.....	.....	....	..	.....	..	..	.	....
Monrovia ..... "	27.00	12.50	....	....	43.00	1.00	.....	.....	1.50	....	1.50	.....	....	22 00	....	.....	..	..	..	.....
Pomona..... "	4 15	6 52	....	....	8.76	.....	.....	1.50	0.40	....	1.50	.....	.....	20.00	....	.....	..	..	..	.....
San Bernardino "	6.50	2.00	....	....	2.00	.....	.....	.....	0.03	..	....	.....	.....	12.00	2.25	.....	5	..	..	....
Redlands..... "	5.00	2.00	....	....	...	10.00	.....	.....	10.00	....	....	1,200	72,500	5.00	3 50	1.50	6	..	..	.....
Riverside ..... "	14.00	2 00	....	....	2.00	.....	.....	.....	2.00	..	....	1,550	1,250	25.00	....	2.17	..	..	13	....
Corona..... "	2.50	3 50	....	....	7.10	.....	.....		1.30	....	5.80	.. .	.....	3.80	...	.....	..	..	..	.....
Anaheim ..... "	5.00	2.00	....	....	2 25	.....	...	.....	.....	....	....	.....	.....	1 00	....	.....	..	..	..	.....
San Pedro..... "	13 00	11 00	....	....	15.75	.....	.....	.....	0.25	....	....	1,500	.....	20 00	1.25	4.75	48	..	..	....
Ocean Park ... "	8.40	17 00	....	....	17.00	.....	.....	....	.....	..	....	41,000	.....	7.20	8 00	6.50	..	..	..	.....
Santa Barbara . "	1.10	... ..	...	....	.....	.....	0.80	.....	0 20	2.00	....	1,550	.....	3.00	....	3.00	3	..	..	1.50 Miles Sandstone Curbs
Fresno... .... "	2.30	6 60	....	....	.....	.....	4.50	.....	.....	.....	.....	....	.....	8 00	...	1.10	..	..	..	....
Modesto. ..... "	1.00	0.60	.	....	0 30	.....	0.30	.....	0.09	..	....	.....	.....	0.08	....	14.00	..	..	..	....
Stockton... ... "	11.00	3 00	...	....	0.25	.....	22 00	.....	22.00	....	....	1,202	100,000	0.25	....	15.00	..	50	..	.....
Chico..... "	0.50	0.25	....	....	0.25	.....	....	.....	0 50	....	....	.....	10,461	.....	3.00	10.00	..	30	..	....
Portland.....Ore.	7.70	.....	4.10	5.20	4.10	.....	4.80	.....	.....	...	1.00	40,598	.....	....	2.50	5.00	..	..	..	34,465 Sq. Yds. Gravel Pavement 20,867 Sq. Yds. Bitulithic Pavement
Oregon City.... "	0.08	0.16	....	....	0.16	.....	....	.....	0.16	....	....	.....	2,000	.....	.....	.....	..	..	..	25 Sq. Yds. Brick Pavement
Reno .....Nev.	3.00	4.09	....	...	0.25	0 45	....	.....	0.06	....	....	27,432	16,427	.....	1.09	2.02	..	..	..	.....
Victoria.....B. C.	0.70	10.00	....	...	0.20	0 20	.....	.....	.....	....	....	.....	33,000	.....	3.00	2.00	10	..	..	7,150 Sq. Yds. Wooden Block Pavement

Garbage Disposal. The city erected during the past year a garbage destructor, which a few months after construction was partly destroyed by fire. It has been rebuilt and is again in use. The garbage is collected twice weekly in the residence district and daily in the business section, the property owners being required to furnish their own receptacles.

General Improvements. Large sums are being expended for bridge, park improvements, new fire buildings and equipments and for city schools; library quarters are inadequate and a new building will be built in the near future.

SAN FRANCISCO, CAL.

So much has been written concerning the San Francisco earthquake and fire that the subject will not be undertaken in this review further than to state that the writer's recent observations in that city confirm the preponderance of statements heretofore made, that good construction stands out in conspicuous evidence to prove that buildings can be and have been constructed to withstand, with little injury, earthquakes as severe and no doubt even more severe than the earthquake at San Francisco. On the other hand, it has been proven that it is extremely difficult, from a cost standpoint, to erect structures not subject to very serious injury when subjected to such a fierce and uncontrollable conflagration as the one through which San Francisco passed.

The heat was so intense that even the granite blocks with which many of the streets of the city are paved, spalled badly, while the asphaltum of the asphaltum paved streets was burned clean to the base, leaving only the black sand which was part of the asphalt mixture.

On many other streets, however, where the heat was not so intense, the asphalt streets suffered but little or no injury.

T. D. ALLIN.

PASADENA, CAL., September, 1906.

THE PRESIDENT: That closes the program up to date. It has been suggested that we hold but one session tomorrow morning, and continue in session until we close the program. We have a considerable number of papers, nearly all on paving, and it was suggested that one of these papers be given this evening, but as it is now half past ten, I will not call for it unless you will promise to stay. We will therefore be compelled to meet at the time set in the program, and the time set is ten o'clock,—say we make it 9:30.

THE SECRETARY: I would like to say if there is any of the delegates who have railroad certificates, and have not handed them in, I wish that they would do so now. I would also say if there

are any members who have not paid their dues, the Secretary would much prefer to have them here.

THE PRESIDENT: If there are any people who have not registered, I would be very glad to have them register.

Mr. Folwell then read his report as delegate to the installation of President James of the University of Illinois.

Your committee appointed to attend as delegate the installation of E. J. James as President of the University of Illinois, beg to render the following report:

The exercises extended over an entire week, but your non-resident delegate, Mr. Folwell, was present only during Wednesday and Thursday. Mr. Tillson was unable to attend.

On Wednesday morning the delegates were formally received in the University armory, provided with badges and programs, and permitted to examine the buildings. In the afternoon following a review by the State Governor of the University Regiment, the delegates formed in procession and marched to the armory, where the inaugural exercises were held. There were in the list of delegates 247 from universities and colleges in all parts of the world; one each from the U. S. Army and the Illinois National Guard; 32 from learned societies (including our own); two from religious organizations; 40 from agricultural organizations; 29 city and county officers; 50 from the Illinois boards of education; 33 from miscellaneous clubs; what percentage of these were present it is impossible to say. Most of the university and college delegates were gorgeous in multicolored robes of silk and velvet, and formed a striking picture in the procession. At the inaugural addresses were made by the Presidents of the Universities of Michigan, Johns Hopkins, Kansas, Tulane, Chicago, of Illinois College, and others, followed by that of President James.

During the evening an official reception was given by the new president to the delegates, which was followed by students' torchlight parade —the most interesting thing which had so far happened. Thursday was taken up with visits to the buildings and meetings of engineers and other scientific delegates. The remaining two days, which we missed, were given up to educational conferences and a football game.

It was undoubtedly the most elaborate and spectacular college function which this country has yet seen.

A. PRESCOTT FOLWELL.

THE PRESIDENT: Is there any further business to come before this Society at this time.

MR. HATTON: I move that we adjourn.

THE PRESIDENT: Those in favor of that motion will say, "Aye," and those opposed, "No."

Carried.

9:30 A. M. OCTOBER 12, 1906.

THE PRESIDENT: The first matter on the program is the report of the Committee on Disposition of Garbage and Street Cleaning by Mr. T. C. Hatton. Also paper on Street Cleaning and the Disposition of Sweepings.

MR. HATTON: Mr. President and gentlemen. Regarding the report of my committee, I beg to state that we have been unfortunate in not getting together the papers that were anticipated, and one of the most instructive papers to the members of the Society and the public at large at this time, was to be presented by Mr. Bayles, Consulting Engineer of New York City. This will undoubtedly be of value to the Society in general, but I have received a letter from him since I arrived here in which he says that owing to the sickness of his wife, and a change in his household affairs, he has been unable to be with us or complete his paper, but that he will have it done in a few days, and I suggest the paper be read by title, the title of which is the "A Proposed System of Final Waste Disposition for the City of New York," and it be printed in the proceedings. The City of New York has this matter up in a very extensive form; they have appointed commissioners to look after it, and I think Mr. Bayles is a member of the commission, if I am not mistaken.

In addition to that your chairman attempted to get papers from several of our members situated in the different parts of the country on this subject, but I regret to say, that while several of them promised, none of them came up to their promises, and right here I want to state that it should be the duty of every member of this Society when he promises a paper on any subject, to abide by that promise, if they have to stay up at nights and lose sleep; there are none of them too busy to do that, after they promise it.

When we come to our convention and the chairmen of the different committees expect to get these papers and they are not here, it is very embarrassing. The paper I presented to you has been compiled through more trouble than the contents of the paper would indicate. Early in the year I got out 215 circular letters, which I sent to the mayors and other city officials of as many cities of the United States, and I am glad to say that out of the 215 circular letters I received 210 answers, which I think is rather remarkable, those letters embraced these inquiries, as to street cleaning; what was the cost, and the cost per item, the best method and the cheaper method of cleaning by machine or hand, which was the most satisfactory by contract or by force account, and the method of the disposal of the street cleaning trash; also the method of gathering ashes, and the cost of final disposition of the ashes; also the method of gathering the garbage, its cost and disposal of same. I must say, however, gentlemen, the answers after they came in with a few exceptions were so irregular and mixed with so much matter that was not pertinent to the subject, that when we come to compile a table, the table was really of little value to the Association, so I had to pick out the real pertinent parts of the answers, and condense them into a report so that a layman could understand it as well as a technical man. This paper is entitled "Street Cleaning, Collecting and Disposal of Ashes."

STREET CLEANING AND THE COLLECTION AND DISPOSITION OF SWEEPINGS AND ASHES.

BY T. CHALKLY HATTON, CHAIRMAN COMMITTEE ON STREET CLEANING AND GARBAGE DISPOSAL.

The cleaning of streets has become a problem which during the past few years has caused the municipal officers having the matter in charge many wakeful nights following days of numerous complaints from righteously indignant citizens, and if this paper in any way alleviates the suffering of either, the writer will feel that the time expended upon its preparation is not wasted.

In attempting to prepare a paper which may assist the officers aforesaid the writer has encountered the utmost difficulty in securing comparative costs of street cleaning, and if he had been less familiar with the quality of work done in the several cities from which information was

obtained, the comparative costs, as obtained, would when placed side by side, been ridiculous, but his personal knowledge of the several cities led him to see that the cleaning of streets was performed on a basis of the officers' "points of view," which was largely governed by the point of view of the average citizen and what had been done by those who preceded him in performing this duty. For instance one city of 80,000 population expended in 1905 only $6,000.00 for cleaning its streets, or seven cents per capita. That would seem to the average reader that this city was being ably and economically managed, whereas the writer, during a recent visit, found the conditions of the streets to be filthy in the extreme, and this illustration will fit almost any other city in this country which shows a per capita cost for cleaning its streets of less than forty cents. One of the most important duties of a municipal government is to keep its streets clean. It should not be content to sweep them occasionally, say once or twice a week, where built up, but no organic matters subject to decomposition should be allowed to remain upon the surface of the streets beyond a few hours at most.

The householder is required by the Boards of Health to remove from his premises all organic matters subject to decomposition for which he has no longer any use. Should his back or front yard become dirty from such organic matters he is fined and made to clean up. when at the same time the municipal government is permitting horse droppings and vegetable refuse to lie for days at a time within a few feet of his front windows and doors unless a windstorm has come along and removed it inside his premises, which is often the case.

Animal and vegetable wastes, when dried, as they are after lying upon the surface of the streets for a few hours, are harmful to the human system. They find lodgment in the membranes of the nose, mouth, ears and eyes and become an irritant which largely induces catarrhal trouble, which is so very much more prevalent in the cities of the United States than in the European cities, where the streets are kept so much cleaner. The citizen of the average place where the streets are not well cleaned gets more or less accustomed to seeing horse droppings lying undisturbed upon the streets, and thinks little of it, but after he has lived in a city where these droppings are not allowed to remain only long enough to get them, while fresh, into a receptacle, he changes his point of view very much and views such dirt with feelings of disgust, and he has become a better citizen for having that feeling.

Before Col. Waring undertook to clean the streets of New York in 1895, he stated that the streets were almost universally in a filthy state. In wet weather they were covered with slime, and in dry weather the air was filled with dust. Artificial sprinkling in summer converted the dust into mud, and the drying winds converted the mud to dust. This is a very fair description of the condition of the streets as they exist to-day in the majority of the cities of the United States, and yet large sums are annually expended by these cities for cleaning the streets

just as New York expended large sums prior to 1895 for attempting to keep its streets clean. The trouble seems to lie not in the smallness of the appropriations, but in the lack of system adopted by the average city official in having the work performed and the failure to have the laws observed which are usually a part of every city's code.

For instance the writer has frequently observed the surface of main streets in cities littered with papers, fruit skins, ashes, sweepings from stores and dwellings, where he knew ordinances were in existence prohibiting the depositing of all these substances upon the streets. He has observed, as all of you no doubt have done, pedestrians throwing whole newspapers in the streets, banana skins and other like matters also being thus disposed of while a policeman was standing by but paid no attention to this infringement of the law. He has seen the janitors of stores and business houses in entire blocks cast the sweepings in the street gutters without being molested by the conservator of the law as he patrolled the sidewalk in front of these stores, and yet there was an ordinance prohibiting this.

The writer believes the streets should be cleaned thoroughly and be so maintained, but he also believes that it should be the duty of every citizen to do his share towards preventing the littering of the streets, and he also believes that every good citizen concedes this point. Then the first point to be solved by the city official having the cleaning of the streets in charge is to prevent their becoming dirty so far as he is able under the law. To do this he must call in the assistance of the police department and have the police instructed to have the ordinances fully carried out. This step if honestly and firmly performed will soon change the point of view of the whole city, as your point of view is changed in the European cities, if you attempt to throw a piece of paper upon the surface of the streets in sight of a policeman. This is not a hardship to the average citizen, and the writer has seen its wholesome effects in many instances. In fact the citizen soon prides himself in being a part of a community which carries out such a law, and becomes more careful of his person and premises. It is of twofold assistance to the young in that it practically educates them to a spirit of tidiness. Col. Waring organized the youngsters in the slums of New York into street cleaning leagues, and the writer has done the same, with the result that this class of ordinarily careless children became tidy and careful of their personal appearance, and these lessons go with them throughout their lives. It is a noted fact that wherever a municipality improves the appearance of its property, either by sewering, paving, parking or cleaning the owners abutting upon that property will follow suit. Clean streets lead to clean houses and tidy people, and thus the whole community is benefited by the municipality keeping its own territory clean.

There is no universal system of street cleaning in use in this country in spite of the fact that all the large cities of Western Europe have had a universal system in use for many years with great success. In this

respect we have not been benefited by the experiments made by our neighbors across the deep although we do follow their lead in nearly all other municipal improvements. We look upon ourselves as the greatest people living because we have not studied closely the ways and means of our European friends in accomplishing results which we are still far from having accomplished, and the American municipal officer traveling abroad sees at once how far behind we are.

The official of one American city will declare with the greatest confidence that the methods of cleaning the streets as practiced in New York City or Washington cannot be successfully carried out in his city because the conditions are different, whereas as a matter of fact he cannot clearly demonstrate the difference in conditions, because there are none. He will positively assure you that hand cleaning as a constant operation is far more expensive than machine cleaning, and when you request his proof he cannot produce it because he has kept no accurate record, but from an occasioned observation of the two methods he jumps at the conclusion that the machine is far cheaper.

For instance the writer received replies from the officers of 210 cities of the United States, to the question "which in your opinion is the cheaper method of cleaning streets, machine or hand?" and all the replies from those cities where no records were kept were to the effect that machine cleaning was far cheaper, whereas the replies from those cities where accurate records were kept proved without doubt that hand cleaning was much cheaper. These facts are here stated to show what a lack of information there is upon the subject, and until city officials study the question of street cleaning in a rational manner our streets will still be cleaned in the same old slip-shod extravagant manner as most of them now are.

It might be well at this point to outline briefly what the writer learned from the replies received to a circular letter, sent to the mayors of the cities of the United States, east of the Mississippi, having a population of over 20,000.

Of the 210 cities, 81 cleaned by hand alone by day labor employed under the direction of the street commissioner or a deputy. One hundred and fifteen cleaned by both hand and machines by day labor. Nine cleaned by machine and hand by contract. One cleaned by hand and machine by prisoners. One of over 45,000 population cleaned by private subscription only, and then at irregular intervals.

In 133 cities the sweepings were used for filling in low places on outlying streets and private grounds. In 49 cities the sweepings were used as a fertilizer. Of the 115 cities cleaned by both hand and machine by day labor 72 used the hand labor exclusively by day by which all paved streets in the business districts were cleaned once a day at least. The residence streets which were paved were cleaned from once a day to three times per week. The machines being used by night only. In 57 cities the two-wheel hand vehicle was used to retain the sweepings tem-

porarily as they are swept up by hand. This vehicle having either a bag or metal barrel. The bag, when full, to be tied up and deposited upon the curb line to be removed by the horse wagon following the sweeper. In 37 cities the sweepings as they were gathered by the "white wings" were deposited in the nearest manure pit, and in 20, carts followed the "white wings" picking up the bags of sweepings left along the curb and leaving fresh bags for the sweepers. Of the 115 cities which cleaned by both hand and machine, by day labor, 96 sprinkled the streets ahead of the machines, the others apparently allowed the dust to fly. Eight cities cleaned their business sections after closing hours by flushing the streets from the fire hydrants and allowing all the dirt to wash into the sewers through the inlets.

There are several interesting points brought out in examining the results of these replies. One is that the majority of cities find that the street cleaning is best accomplished by day labor and not by contract. Another that machine sweeping is not popular if done during the day owing no doubt to the interference to travel and the dust which is thus bound to be raised. Again, that business streets are, in the main, cleaned once a day, residence streets, paved, were cleaned on an average of three times per week. Gutters in suburban districts cleaned upon complaints of the property owners. As stated there were 49 cities where the street sweepings were used as fertilizer, and from the writer's personal knowledge of these cities, they are surrounded by the most fertile lands with the most prosperous agricultural communities, from which the writer naturally concluded that these communities have been indirectly enriched by using good sense. And that it will be largely beneficial to any municipality to carefully gather up its street dirt, which is largely composed of manure, and deposit it upon piles or beds in different sections of the suburban districts, making a compost of it, and then permitting the farmers and truckers to remove this compost to the surrounding lands. The municipality will certainly be the winner in the long run by this system of disposal even though its first cost is greater than the present popular system of wasting this manure upon city dumps, and just think a moment of what this popular system is! One hundred and sixty-one cities in the United States east of the Mississippi River sweep up the manure which falls upon the streets, the vegetable refuse which is found more or less in all street sweepings, and the many other organic matters also found therein, and dump them in the partially opened streets, or upon low private grounds inside the city limits, where the organic matter, of which they are largely composed, is permitted to decompose so long as it is exposed to light and air, and the process of decomposition poisons the atmosphere of the entire neighborhood. Much of this organic matter is covered before it is entirely decomposed, a few years thereafter as the growth of the city requires, these low grounds which have thus been filled up with this manure, are improved by building thereon residences and when the occupants of these become ill they call it malaria, whereas

they are being poisoned by living over a manure pile. Such a practice disgusts the senses of refinement of all when they are asked to look squarely into it, and yet it is the practice of 75 per cent. of the cities of this continent, cities which annually expend immense sums for sewers and pure water and for the observation of sanitary regulations. Seems ridiculous, does it not? But it is the result of following an old custom Let us get out of this old custom and solve this question in a rational manner. Let us spend a little more ready cash upon sweeping our streets in properly disposing of the sweepings by utilizing them for fertilizer as is done successfully by many European cities, and as we have so much opportunity for doing.

As has been asserted earlier in this paper the cost of sweeping the streets is known to but few of the officers of the cities who answered the writer's questions. In fact there were but 22 cities where the officers in charge could tell how much per mile it was costing to sweep the streets, and of these only 13 could tell the relative cost of cleaning by hand and machine, and yet there was expended for this purpose in 1905 millions of dollars, all for surface work of such a character that a good clerk working on an average of two hours per week for 52 weeks at a total cost of say $50 could have determined what the unit cost of street cleaning was in the average city.

As hereinbefore stated the answer to the question "How does the cost of machine cleaning compare with the cost of cleaning by hand," was "the machine cleaning is far cheaper," except from those 13 cities where accurate records were kept, and which showed beyond a doubt that the hand-cleaning was by far the cheaper process. The writer some weeks ago called upon the street commissioner of a city of 90,000 population and asked him the above question and the reply was as usual, machine cleaning about one-third the cost, but no accurate records had been kept, although both processes were in use. We went together upon the streets to view the work being done, and incidentally the cost, with the following result: One "white wing" had a district comprising the leading business street of the city, upon which two car lines were maintained. The street was paved with bricks, asphalt, bituminous macadam and granite block. The district cleaned by this one man was 2,700 feet long by 40 feet wide, and he got over it entirely once a day for every working day in the year, except when it rained or snowed. His wages were $9.00 per week. The sweepings were dumped by him in the nearest stable manure pit, which in some cases was two blocks away. We found by this method that this street was being cleaned for $1.25 per 10,000 square yards. Upon an adjoining residential street paved with bricks, the machine gang was then at work, and consisted of one two-horse sweeper, one two-horse sprinkler, six one-horse carts, one foreman and 11 men. Double teams 50 cents an hour, single teams 31¼ cents, foreman and six men 20 cents, 5 men 17¼ cents, the sweepings were being hauled 5,700 feet average haul, and dumped upon low ground. This gang

cleaned at the rate of 3,305 square yards an hour, and at that rate the cost was $15 per 10,000 square yards or over ten times the cost by sweeping by hand. It is needless to add that the result of our investigation changed the opinion of that street commissioner, as it will do that of any other who will take the time and trouble of looking into it, remembering that the same condition of street must be maintained by either process.

The result of the writer's investigation has shown that the cost of sweeping streets by machine averages $7.53 per 10,000 square yards; by hand $2.45 per 10,000 square yards, and flushing streets about $3.18 per 10,000 square yards. That the cost per capita per annum for cleaning streets in the cities east of the Mississippi was in 1904 and 1905 53 cents and that the cost in those cities which kept its streets well cleaned was 75 cents per capita per annum. The last named sum being a very reasonable one when it is considered what it secures.

The writer is of the opinion that the best results, both as to quality and economy can be secured by cleaning paved streets by a well organized and efficient force of "white wings" by which the sweepings are collected and deposited in bags upon the curb lines to be picked up by carts which haul these sweepings to a compost dump located as near as possible to the district cleaned, when, after adding some hyperphosphate, the farmer is invited to come and haul it away. He believes that the cleaning should be done so frequently that no organic matter should be allowed to remain upon the surface of any streets for more than twelve hours and in the business streets where the travel is heavy, the cleaning should be done constantly by "white wings" having but 2,500 square yards of surface to cover per day per man.

After the business of the day is over a gang of men should flush the surface of every business street by means of hose attached to fire hydrants, and thus dislodge the fine dust left upon the surface by the hand broom. In the morning the street thus flushed presents a clean, pleasant appearance and it is free from those harmful dust compounds which induce catarrh, and other throat troubles. This process, properly administered, is within the means of any city large or small, the smaller the city the easier the process becomes. The cleanest kept city in the United States to-day is Washington and it has the largest street area per capita. The next cleanest kept city is Greater New York where the obstacles for maintaining clean streets are far greater than any other city of the United States. What can be secured in either of these two cities can be secured elsewhere if the powers that be "can simply get the proper 'point of view.'"

As an adjunct to the street cleaning process, all laws should be passed and observed, for preventing the unnecessary littering of the streets, and towards this end the city should erect and maintain proper receptacles upon the street corners for holding waste papers carried by pedestrians and for fruit peelings or other things thrown away by those

who use the public streets, and no business house should be permitted to sweep the dirt from its building upon the streets. Instruct your police force that these laws must be rigidly enforced, then note how proud you will be at the end of a year that you are a part of such a cummunity.

The collection of ashes and solid household wastes is another duty devolving upon the community which has caused many anxious moments to the conscientious city officer. The queries which have presented themselves to his mind time and time again are as follows: Should the collection be a public or private duty? If public duty can it best be done by an annual contract for a lump sum, or by the load, or can more satisfaction be obtained by doing it by force account? How should this waste material be disposed of and where? What system is best to minimize the many objectionable things necessarily connected with collecting this material? and lastly, What should the collection and disposal of this material cost?

In considering this question the writer excludes the collection and disposal of garbage which he considers outside the limits of this paper.

Of the 210 cities heard from in 33 the collection of ashes and other household wastes was done by the individual property owners or occupants, in 74 the collections was a public duty but let out by contract at a lump sum, per annum. In 13 the work was done by contract at a certain fixed price per load of specific volume, and in 92 the collection was made by teams owned by the city, the labor being performed by force account. In some of the latter cities the wagons only were owned by the city, the horses and drivers being hired by the hour or day.

Thus it would seem that the large majority have reached the conclusion that the removal of waste household matters is a public duty. In those cities where it is left for individual effort many nuisances arise. For instance adjoining vacant lots become the depositing ground for ashes from sources unknown to the authorities. Alleys are frequently used as depositories, and unpaved streets get a lot of it when no one is looking, thus reducing the cost to the individual householder and increasing the nuisance to many.

The writer is firmly convinced that the best results can be obtained by the public assuming the duty of removing these waste materials.

Where the work is done by contract the general opinion is that it can thus be performed much cheaper, but the writer questions this considering of course that the same efficiency is maintained. In cities of 20,000 population or over, a regularly organized force of men and teams can be constantly employed during the winter months upon this work, so that no time need be lost if the city is properly divided into districts, and it becomes the duty of the force to cover each specific district in a certain unit of time fixed by ordinance. During the summer months the force can be reduced to such size as may be ample to cover the city which has been divided into larger districts. By this method as much work can be performed by the men and teams under competent

supervision as could be performed by a contractor, and thus his profits could be saved. The city's force would have no incentive to miss house after house as the usual contractor's force does, and the work can thus be done much more satisfactory and certainly at the same cost if not less. If the work is to be done by contract or the writer believes it can be done more efficiently by paying a unit price per cubic yard removed, which would give the contractor an extra inducement to secure all the wastes he could, and thus the cause for the many complaints from the householders would be minimized.

With six exceptions all the cities heard from dispose of their ashes and solid household wastes by dumping them upon low ground or for filling in streets in suburban districts. In six cities these materials are sorted over by either independent persons or laborers employed by the cities, and all matters having any value are collected and sold, the residue either being taken to sea and dumped or used for filling in low ground.

The custom of dumping the ashes upon the low suburban streets of a city may be a necessary one, but it is certainly a nuisance to many residents who may be so unfortunate as to be compelled to live in the proximity of these ash dumps. Their houses are constantly filled with ash dust, and their nostrils with noxious odors, neither of which would be long suffered if these residents happened to be influential members of the community.

There are hosts of things in the average household wastes of a city, which are valuable. For instance the privilege of sorting the ashes and rubbish from the city of New York was in 1896 sold by the city for $140,000.00. Later the city retained the privilege and provided modern methods for separating the valuable matters from the rubbish, and realized a far greater profit from this source. Everyone interested in this subject has been impressed by seeing the number of persons around a city's ash dump engaged in picking out the valuable materials. Many of these persons live entirely by the money received from the sale of such materials as they thus pick up. Now why should the city not secure this value to itself, and thus materially reduce the cost for the removal of household wastes? The separation could be done much more economically and thoroughly if the city undertook it by first requiring the householder to separate all other matters from the ashes, and then providing proper depots for the reception and separation of these matters. The ashes should then be dumped at such places and in such manner as to protect every citizen from the nuisance whether he is rich or poor.

There are many systems in operation in the cities heard from for securing the ashes and household wastes from the householder. These embrace the putting of all such matters in a common receptacle; the separation of the ashes by putting it in one receptacle; the paper in another, and other wastes in a third. In some cities the kind and size of such receptacles is specified. The receptacles are in some cities placed upon the sidewalks near the curb line, in others near the stoop line,

while in others the collector is required to go into the premises upon which the wastes are to be kept in easily accessible places.

Probably the best system of collection of ashes and rubbish is that which is in use by the city of Buffalo; it certainly minimizes the objectionable things connected with such collection to a greater degree than any other system of which the writer has any knowledge. The collection is done by contract. The collection being made once per week from November to May and twice per week the balance of the year. The more frequent collections in the summer months is due to the fact that the garbage is collected under this contract and by the same force. The householder is required to provide three separate receptacles, one for ashes, another for rubbish and a third for garbage. Any not so separated is not removed. There are three classes of wagons used, one for ashes, another for rubbish and the third for garbage. There are three separate gangs of men employed in each force. One goes ahead of the wagons, carries the receptacles from the premises, and sets them upon the sidewalk near the curb, the next gang dumps the materials into the wagons and the third gang follows immediately and returns the receptacles to their places upon the premises. The cost of this is 31 cents per cubic yard or $60,000 per annum, or 17 cents per capita. By this method the ashes are so entirely separated from all that is valuable that it can be disposed of without additional expense. The rubbish can be easily picked over and the valuable parts separated, whereas the garbage is hauled directly to the reduction plant. The householder is not required to get his clothes soiled, and his religion warped by rolling a barrel or box of ashes out of the yard, down the steps to the sidewalk, and carrying the empties back when he returns home at night. The appearance of the streets is not spoiled all day by unsightly barrels and boxes standing upon the sidewalks, where they are frequently upset by mischievious boys, and the atmosphere of the neighborhood is not polluted with decaying garbage.

The cost is but little more and the benefits are far greater than the usual method of requiring each householder to set his ashes and rubbish upon the sidewalk in the morning, where it frequently remains all day, and sometimes two days at a time. The writer believes that Buffalo performs this duty better than any other city from which he has secured information, and he knows from personal inquiries from its inhabitants that the system has proved very satisfactory.

The average cost of collecting ashes, solid household wastes and garbage is 26 cents per capita per annum, which includes the disposal of the ashes and wastes, but not the disposal of the garbage. The writer could not well determine the average cost of collecting the ashes and wastes alone, as in the majority of the cities heard from the three materials were collected by the same force, or under the same contract, but from such information as he was able to get the indications are that the average cost is 17 cents per capita per annum.

In closing this paper the writer desires to call out from its contents a few of what he considers its most important points:

A well governed city can only be so considered when its streets are maintained constantly in a cleanly condition, and that no matters subject to decomposition should be allowed to remain upon the surface of the streets for a greater period than twelve hours.

A well organized hand cleaning force of street cleaners is by far the most efficient and economical method of keeping the streets clean.

The street's sweepings should be utilized as fertilizer and never used for filling in low lands liable in the future to be used as building sites.

Flush the surface of the business streets every night with an abundant supply of water, so as to remove the harmful dust.

Keep an accurate account of the cost of cleaning the streets by any particular method in use, and so itemize such cost as to be of use to your colleague in a nighboring city.

Collect your ashes, household wastes and garbage so as to minimize the nuisance to residents and passers by, and require the separation of the three classes of materials.

Don't dispose of your ashes by dumping them in front of the little home of your suburban resident, and don't throw away the things of value contained in the ashes and house rubbish.

Provide receptacles upon the corners of the streets for retaining waste materials in the hands of pedestrians, and cultivate cleanliness and tidiness in the minds of your school children by an occasional talk to them by one of the leading city officers.

If this paper has given you any new or condensed information upon the subject of street cleaning and the disposition of ashes, or has started your thoughts to solving the problem of how to do the work better and cheaper than you are now doing it, the writer will feel repaid for the hours he has expended from a very busy life in securing from the officers of 210 cities such such information as is contained in the paper.

T. CHALKLY HATTON,
Chairman Committee on Street Cleaning and Garbage Disposal.

THE PRESIDENT: The paper is now open for discussion.

MR. FOLWELL: I would like to ask the gentleman in the figures he gave as to cost of cleaning the streets by flushing, if that includes the cost of the water used?

MR. HATTON: No, sir, it does not.

MR. FOLWELL: The cost of the water would have been quite an item in connection?

MR. HATTON: Yes, sir.

MR. FOLWELL: It seems to me that this paper is the most valuable paper that we have read at this Association; at least it is interesting to me, and should be to everybody that is interested in sewers, paving or anything else; simply as a citizen he should be interested in the welfare of his own city, and it seems to me it should be of great value. There is one matter that might be brought out in some of these conventions, which has continually been forcing itself upon my mind for some time, and that is, so many of our cities are run on the basis of how much money they have spent, rather than the good they got out of the expenditures. It don't seem right to the people when asked to vote more money for cleaning the streets—because a great many of the cities do not clean their streets properly. The citizen would say the taxes would be so much a year, and that same man has probably increased the cost of his household expenses 25 per cent., disregarding the actual raise in the material, his ideas grow as the country grows, he thinks his yard has to be kept in better shape, and keep his lawn, flower gardens, etc., in better shape, and he thinks this is money well spent, yet when the city tries to do the same thing in keeping its streets clean, he thinks it is an expensive administration; he should desire to keep the streets as clean as he does his own premises.

MR. HOWARD: The duty of the engineers in this country is constantly educational. The legislative branches of our cities, and I am speaking now of my twenty-five years' experience in street work in different cities, seldom stay in office long enough to become skilled, and I am free to say that where politics is allowed to enter into this matter many of our cities will not sustain our engineers and men who strive night after night for most of the engineers do their real work at night. We have to be diplomatic, and the street cleaning is the most vital thing not only for the health of the community, but the maintaining of pavements, for which, including construction, we spent last year in the United States about $64,000,000, more than the cost of laying new railroads and maintaining them in the United States. The pressure

of water forced down on a pavement is very injurious to it, because it destroys a pavement, not only by erosion above, but also penetrates through tiny openings and gets under a pavement, and lifts it as a whole or in part from the foundation. Take a paving brick 8x3x4 inches deep. It would have 24 square inches on the under side. A pressure of water sixty pounds per square inch penetrating below the brick would develop a theoretical lift of 24 times 60, or 1,440 pounds under that brick. If only one-fourth of the pressure was effective, there would be 360 pounds under a brick weighing only 9 pounds, the average weight of paving bricks. The only thing which retains the brick in place is cement grout around it. In practice, this grout is often imperfect and fills only a portion of the joints between bricks. Thus water applied under pressure from hydrants or flushing machines constantly lifts paving bricks from their bed, loosening and destroying such pavements, as well as other kinds. I was in Chicago fourteen days at the request of the Union League on the street cleaning problem, and I am not an expert, but I noticed that the water lifted the bricks very quickly; I have also seen them lifted in St. Louis by the pressure. Now as for granite blocks, I have seen it lift them; asphalt blocks weigh about 16 pounds set with bituminous cement, are not so quickly affected; water goes in a little hole, no matter how small, and the hydraulic lifts these things, and it is disastrous to these pavements.

MR. REIMER: I presume, as Mr. Hatton has had so many replies from various cities, there must have been many where macadam roads are in use. He referred chiefly in his paper to brick pavements, hard smooth pavements in reference to his cleaning, and why I speak of this is, in the little city over which I have charge of all the streets and waysides, we have nothing but macadam surface streets, and we sweep them by hand, and try to keep them clean, and are generally credited with having a clean city. I was very much surprised to get a report from one of our Massachusetts cities from a party who had been there; he was speaking to the street commissioner of that Massachusetts city, and

was telling him how we swept our streets here, and he said: "You don't mean to say they sweep macadam streets?" "Yes," he said. "Not with brooms." "Yes, with brooms." And he seemed astonished to find out that we swept our macadam streets with anything. I do not know what the condition of his city could be, but at the same time Massachusetts cities have the credit of being in good shape.

MR. HATTON: In regard to sweeping macadam streets, I got a great many reports about macadam, and I did not include it in this because it would have been too long. The gentleman's experience with his friend reminds me of a few years ago when I was before the Civic League on this question; they had invited several city boards and councils to hear my address, and I was speaking about cleaning macadam pavements and how it was done, and I think four or five members of four or five different cities came up and said one after the other that it was absolutely impossible, they could not clean macadam pavements without injuring the pavement and went on record that such was a fact. Nevertheless they do clean them in almost every large city in the United States, and particularly in the surrounding cities of Montclair, and they don't injure the pavement; they can clean dirt or dirt streets without injuring them. I want to take this opportunity of expressing to the Birmingham citizens and its city engineer, the appreciation that we have all felt driving over these streets, as to their cleanly appearance. I have heard delegate after delegate make that remark, whether they cleaned these up for our special benefit, or whether they kept them clean; I cannot tell, but be that as it may, they are clean, and we should extend them the glad hand for doing so, if they only keep them up in this way.

MR. KENDRICK: I wish to say that I do not wish to take any credit for the street cleaning on myself. Mr. McCartin has entire charge of that matter, and I am sorry he is not here to explain his method of cleaning the streets. I will also say that the streets for the past few days have been in their normal condition. They are usually kept as clean as they are today, and no special efforts have been made for you gentlemen.

A MEMBER: I wonder if the gentleman, Mr. Hatton, will not change the word in regard to the boys, from malicious to mischievious?

MR. HATTON: Yes, sir, I will make the change.

THE PRESIDENT: We will have to pass the next subject, the report of the Committee on Street Pavements, Mr. Owen, chairman.

MR. OWEN: This seems to be quite a large issue at this time and evidently exciting a great deal of interest, because I have a great deal of material which might be submitted to this meeting, but whether you have time or whether you desire to hear the whole of it, is a question for you gentlemen to judge, but there are certain things I would like to present which are questions paramount and should be part of the report of the committee. The committee have outlined their program on the subject, stating first the report of the committee itself on the general trend and progress of the paving question of the country, consequently we will have a report from one member of the committee, of the condition of paving question in the western states, then we will have three or four individual papers on the different parts of roads and street improvements, and to bring the matter up, I would suggest that the report of the committee on the general condition of pavements be first given to you. Mr. Howard has been very kind to take the onus of a large portion of this on himself, and I will ask Mr. Howard if he is here, and ready to read the report.

REPORT OF COMMITTEE ON STREET PAVING.

Paving and maintaining the streets and roads of cities and densely populated counties is a difficult and expensive portion of public work. Ultimate economy means good first construction and prompt repairs, instead of neglect and relying only on what is termed the "life of a pavement."

The past tendency to depend for good pavements on bonds or guarantees is beginning to cease. The responsibility for good construction and maintenance is being gradually placed upon city engineers. Where a city depends upon a guarantee or bond, this means to transfer the responsibility from the engineer to the legal department of a city. Lawyers do not inspect a pavement and compel a contractor to keep it

in good order. They wait till a pavement has become useless, as, for example, with poor brick and certain kinds of asphalt pavements injured by weather and light traffic, and then try to collect cash damages. The people would prefer to have a pavement on the street rather than a bond or cash damages. Your committee recommends that pavement guarantees be gradually abolished and that city engineers shall be made responsible to secure the best pavements of various kinds called for on different streets and roads. Architects are held responsible for the construction of public buildings. They do not depend upon guarantees for proper construction. City engineers see to it that sewers and water works are constructed correctly. Such works do not depend upon bondsmen for lasting qualities. It is not the fault of the engineers, but generally of the legislative branches that guarantees and bonds have displaced true inspection. Under the present political conditions, however, no engineer who insists and shows himself competent in preparing specifications and looking after pavement construction and repairs, is interfered with by aldermen or members of boards of works.

In our cities during the past year the tendency has been to continue to get rid of old cobble and rough stone pavements, and to lay pavements with smooth or even surfaces. The use of durable foundations is steadily extending, for the general reason that the wearing surfaces of pavements, whether of blocks or various kinds, asphalt, bitulithic or other material. can thus be economically and better maintained in constant order.

In the suburbs of cities and in densely populated counties, earth, gravel and poorly constructed roads are steadily being replaced by properly constructed macadam and telford. In some places these are being treated with dust reducing compounds of various kinds. These compounds are often patented or proprietary and in experimental stages. Great progress, however, is being made not only in the materials used, but especially in the methods of application. The destruction of macadam surfaces by weather and traffic augmented largely by automobiles, makes the problem of durability and suppressing dust more important than ever. A special paper by the chairman of this committee will give additional information on this subject. The roads are being placed in the hands of experienced engineers to secure more economic and efficient construction and maintenance, not possible under old methods of superintendence.

The principal kinds of pavements which have been laid during the past year are as follows:

In large cities a decreasing amount of asphalt for new construction; a decreasing amount of granite block, but where laid the blocks are better laid than ever, and almost always on concrete foundations; an increase of the bitulithic pavement in many cities; an increase of treated wood block pavements on concrete foundation in a few cities; a small increase of brick pavement, much being with better bricks with joints filled with cement grout and laid on concrete foundations.

In medium sized cities very little granite and other stone block pavements have been laid, but more of it on concrete foundation than formerly; large amounts of the bitulithic pavement; a little treated wood block pavement on concrete foundation; a slightly increased amount of shale or better class of brick and a decreased amount of fire-clay or poor class of brick pavements; comparatively little asphalt pavement, except for re-surfacing old asphalt pavements; macadam with and without telford foundation to some extent in cities on outlying streets and avenues.

In small cities almost no asphalt pavement has been laid in the past year except in few cities for the first time; a very little treated wood-block on concrete foundation in a few cities; a slightly increased amount of miscellaneous brick pavements in cities of the middle west; an increasing amount of bitulithic pavement in cities previously using it, and in cities not having previously used it; macadam has been extensively laid as usual in small cities.

In suburbs and well populated counties the general trend is for an increasing demand for a perfect surface whether in broken stone or gravel road and also to the elimination of the dust problem due to the enormous increase of travel by automobiles. The dust problem can only be solved in an economical way by experiments and investigation of the use of extraneous material such as crude oil or tar.

Present pavement foundations are worth brief attention. Granite brick and wood-blocks are being placed upon cement-concrete foundations. Bitulithic and asphalt pavements continue to be laid upon suitable foundations, either of Portland cement-concrete or of coarse crushed stone thoroughly compressed and the upper surface filled and coated with bituminous cement. This latter is called a bituminous base and is successful on well drained and on unyielding sub-soils. Hydraulic cement concrete foundations have ceased to be roughened by the bad methods of chipping them with picks, or by partial incomplete tamping, so as to leave coarse stone projecting above the mass of concrete. One method cracks the concrete from the blows of the pick and removes some of the binding cement and mortar. The second method, tamping only sufficient to allow stones to project on the surface of the concrete, was extensively used and abandoned. Such imperfect concrete, however, is the basis of a patent or claims of a patent. This method leaves voids in the concrete by failing to tamp it until all the voids are filled. The resulting foundation is weak and not uniform.

The best practice, now extensively used in laying hydraulic concrete foundations for asphalt and bitulithic pavements, is to tamp the concrete until free mortar appears freely over the surface, then to immediately scatter or spread thereon a thin layer of clean broken stone of about two inches or a little less in size, and tamp the stone about half its depth into the soft surface of the concrete. These stones are thus imbedded in the base and projecting above effectually roughen the surface of the concrete and prevent the binder course of an asphalt pavement, the

asphalt pavement itself, or the bitulithic pavement surface from slipping or forming rolls or waves. Your committee suggests that the specifications for concrete foundations of asphalt and bitulithic pavements would be improved by requiring tamping and roughening with clean broken stone as described above.

Telford foundation or some modification of it, or at least coarse crushed stone is being more and more used under macadam.

As to quantities of pavements in the United States, certain pavements have steadily increased and warrant a brief review.

Asphalt pavements of various kinds and qualities are still being laid, but with a very small rate of increase. It had its rapid increase during the eighties and nineties due to a demand for a comparatively quiet and sanitary pavement (that being then the only available one) and due to a practical monopoly combined with a system of agents or promoters. The asphalt industry is now somewhat broken up. There are several sources of supply and several companies and contractors laying these pavements. The result is cheaper and poorer work. Cities, with few exceptions, are not equipped to know, during the construction of asphalt pavements just what they are getting, good or bad. Excessive repairs and resurfacing of asphalt pavements, especially of those which decay, now falls on cities; guarantees or periods free repairs having elapsed. Many cities, therefore, hesitate to lay more asphalt pavements, at least until they can be sure from inspection of their own engineers or by special experts employed, whether or not they are getting good asphalt pavements.

Wood pavements some years ago were used in several cities and poorly laid. Such pavements were but temporary street coverings, and practically all disappeared. Many western cities, never having had experience of the great Nicholson wood-pavement fiasco, which put Washington City several million dollars in debt, to be paid long after the blocks had disappeared and which bankrupted Elizabeth, N. J., and embarrassed several others. Eastern cities seem to have forgotten the wood-block pavement craze of thirty years ago and are again having wood blocks offered to them. Many cities, however, have investigated wood pavements, with the result they demand concrete foundations and blocks treated by creosote or other equally good method to keep them from decay. Twenty cities have laid in the past seven years very small amounts of such wood pavements as experiments. About thirty other cities have laid during the past six years amounts varying from 1,000 square yards to about 350,000 in New York City. The increase of treated bood-block pavement, on concrete foundations is principally in large cities which can afford this pavement. It is used on streets of noisy traffic to suppress the noise. Because of the lack of experience of the true cost of maintaining wood pavements, cities eventually using them may have to pay much greater prices than at present. About 30,000 square yards of treated wood on concrete was in the United States in 1900. The average increase since then has been about 160,000 square

yards annually. There are now about 1,000,000 square yards of these wood pavements in a little more than 50 cities of the United States, equal to about 57 miles of 30-foot roadway.

The bitulithic pavement is a modern pavement of a specific kind, laid under certain patented processes, methods and mixtures. Without describing this pavement more than to say that the wearing surface consists principally of crushed stone mixed in predetermined proportions and having a minimum amount of voids, and the whole mass cemented together with special bituminous cement which also fills the voids, it is sufficient to report that this kind of pavement began to be laid in 1901, in eight cities to an extent of about 20,000 square yards. Its increase since then has been an average of about 1,135,600 square yards annually. It is now laid and being laid in about 131 cities with an aggregate of about 5,698,000 square yards, or about 323 miles of roadway thirty feet wide. This pavement is worth attention because used by so many municipalities. It seems practically noiseless, little affected by weather and not as slippery as other kinds of monolithic pavements. There have been a few attempts to lay substitutes or imitations of bitulithic, but poor pavements or patent litigations have followed.

Brick pavements for many years were their own worst enemies, because of weak bricks and poor construction. During the past few years strong efforts have been made by some cities and by several makers to increase the requirements of the specifications and tests of paving bricks, so as to secure pavements better able to resist the action of weather and traffic. A reasonable degree of success is attained in some cities especially where complete specifications containing fully defined, technical tests, followed by a thorough inspection during construction, is the rule of procedure.

Macadam and telford pavements during the past year have been laid and repaired with more care than ever on certain streets and in the suburbs of cities. The demand and need for them is greater as the suburban population increases.

Respectfully submitted,

JAS. OWEN, Chairman,
J. W. HOWARD,
E. A. HARPER,
Committee on Street Paving.

MR. OWEN: Mr. Harper, of Kansas City, said he regretted it very much, but the pressure of his work kept him from being here with us, but he has sent a communication on the practice of the Kansas City country, which I think probably might be of interest.

PAVEMENTS OF KANSAS CITY, MO.

BY EDGAR A. HARPER, CITY ENGINEER.

All our paving in Kansas City is more or less in an experimental stage. We tried the cedar blocks and abandoned them some fifteen years ago. After that came a period in which all paving was asphalt. This asphalt was constructed through promotion by the Barber Asphalt Paving Company, they having agents on the street who worked on commission. The ordinance specifying their particular brand of asphalt, it being the policy of the city to depend upon the ten-year guarantee made by the paving company for the good quality of the asphalt surface rather than upon the inspection by the department. The first pavements laid by this company, during the period when they were building up their reputation, wore very satisfactorily, but of late years since they have gone into the trust, their work does not seem to be as well constructed. Within the last year and a half the Board of Public Works has adopted a method of "Open Specifications," in which they cut out the promotion through petition specifying a particular brand, throwing all the paving companies on an equality, and getting competitive bidding and considerably lower prices for work.

This necessitates an inspection and analysis of the material used by these various companies. We are trying to get the department organized to look after this branch of the work, but through the red tape and complications of a political department, we have not gotten this into satisfactory shape, and hope before another is out to have this department so organized so that we can give a satisfactory report on our asphalt pavements.

The only other pavement that we are trying is the bitulithic pavement, but we have no street laid with this pavement for more than six months, therefore, nothing that I could say would be of any value.

The Park Board has tried the creosoted wooden blocks on a portion of one of the boulevards. We have also laid it as a flooring on one of our bridges. This pavement has only been laid a few months and probably by the end of another year we will have some data on this class of pavement that will be of value. We are using the tamarack blocks with 16 pounds of creosote oil treatment. The boulevard was laid without tar filler, the joints being filled with sand. The first heavy rain after the pavement was laid caused these blocks to swell and in one or two places threw them out of the street grade. This was repaired and we have had no trouble with this pavement since. This was a 60 foot width of street, with an inch expansion on each side. This was probably enough expansion to take care of any variation due to heat but was not near enough to take care of expansion due to swelling of the blocks. The creosote blocks used on the flooring of the bridge were well covered with coal tar, filling the joints and a heavy coating of sand spread over the top while still hot. This was on a 4.7 per cent grade, but we have had no

complaint from the teamsters using this viaduct. All we have heard from seem to be very much pleased with this style of pavement, even with a grade as steep as this.

We have a little Colorado sandstone and some vitrified brick. The vitrified brick used up to the present year has been very unsatisfactory. The various companies promoting their special brick, guaranteeing it for seven years. Within the last year and a half we have incorporated in our specifications the test adopted by the American Brick Makers' Association requiring that all brick used to be tested in a standard rattler. Our requirements allowing a 20 per cent loss during 1,800 revolutions. Since that time our bricks have improved in quality.

MR. OWEN: I have a paper here on "The Municipal Asphalt Plant at Hamilton, Ont.," by Mr. E. G. Barrow, City Engineer.

THE MUNICIPAL ASPHALT PLANT AT HAMILTON, ONT.

BY E. G. BARROW, CITY ENGINEER.

Gentlemen:

Our Society is eminently a practical one, and my connection with it as a member, extending now over ten years, has convinced me that papers describing some work accomplished are generally very acceptable, perhaps more so than those dealing with what should be done, useful as these latter may be. I trust, therefore, that the following account of our municipal asphalt plant may be interesting to the Society. The plant has, to my mind, demonstrated the necessity of every city owning its own plant. Repairs are made with less expense; no delay occurs as happens when dealing with a contractor, and an intimate and exact knowledge is obtained of the quality of the materials and the proportion and temperature at which they are mixed and prepared for use on the streets.

The two principal streets of our city were laid with Trinidad asphalt by the Kramer-Irwin Company some twelve years ago. The annual repairs, especially during the latter part of the ten years' guarantee period, became very numerous, and at the expiration of that time were done by contract at a cost of $1.35 per square yard. The Board of Works, owing to the excessive cost of the repairs, and also the tardiness of the contractor to do the work, decided to purchase the plant from the Kramer-Irwin Company, who did the original work at a cost of $8,500.

This plant consisted of four ordinary steel shell driers revolving on a shaft passing through them. The sand was delivered to drums by conveyors at the front, and after passing through them was discharged in a pit and elevated to a platform; the material from the four drums was then mixed and loaded into a bucket by hand and conveyed to the mixer by a trolley. There were two melting kettles of a capacity of about six tons each, a mixer, air compressor, engine and boiler, oil pump and two oil tanks of a capacity of about 4,000 gallons.

The street tools consisted of a five-ton steam road roller, fire wagon and surface roller, with tampers, rakes and other small tools.

On account of the unsatisfactory service afforded by the mixer, drums and drum shafts, the latter continually breaking the mixer leaking and the crude way of handling the dry sand, these four drums were discarded and a modern Hetherington & Berner single drum sand drier installed with a mixer, sand storage bin with a capacity of eight cubic yards, having attached at the bottom a measuring box, capacity eight cubic feet. The cost of adding new sand drier, sand bin, measuring box and mixer was about $3,000.

The sand drier is a single drum 42 inches in diameter, fourteen feet long, and is provided with exhaust fan for creating draught. The housing for drum is steel and the drum is carried via two bearings, a trunion on front end, and ring bearing on back and riding on rollers which revolve on eccentric pins to allow for taking up any wear. The heat passes around the outside of the drum to the front and then through the drum where it comes in contact with the sand passing through. The sand is conveyed to the drums by elevator buckets and after passing through drum is conveyed to storage bin by an upright continuous elevator. At the front end of the drier there is an opening to get samples of sand to test the temperature. Before passing into storage bin the sand passes through a revolving screen of No. 10 mesh when running surface mixture; in running binder a slide door is opened which allows the stone to go into the bin before it reaches the screen. The material passes from storage bin to measuring box and from there to the mixer, and then to the wagons, which can drive under the mixer platform. The material is not touched by hand from the time it goes into the drier until it reaches the street. We are having a closed kettle made of seven tons capacity with a mechanical agitator in it, and when installed will do the melting down in the open kettle and then transfer the material over to the closed kettle for agitation and delivery to the mixer by compressed air, thus doing away with one man now employed dipping out of the open kettle into the asphalt bucket which is on a trolley running over the kettle.

The plant, with its additions and improvements, consists of a Corliss engine of 45 horse power, with boiler of same capacity, sand drier, two open kettles of six tons capacity each. In addition we will have one closed kettle agitator of seven tons capacity, oil pump, two oil tanks of 4,000 gallons capacity, air compressor and barrel elevator for hoisting material. Capacity of plant about 1,000 square yards of two inch surface mixture per day. Number of men required to run plant, 15, including foremen and all men employed about the plant day and night.

On account of the original grading not being up to the standard the average thickness of asphalt laid in Hamilton this year is over two inches. Since May we have turned out of the plant 3,141 cubic yards of surface mixture and 502 cubic yards of binder. In resurfacing, the concrete has been treated to a coat of paint, consisting of California asphalt, fluxed

to a proper consistency. This binds the surface mixture to the concrete and prevents the water from getting between the two materials; also prevents the surface mixture from creeping. On all new work we are using a course of binder next to concrete of about one inch thickness, and a course of surface mixture two inches thick, at a cost of 90 cents per square yard, mixing and laying. This includes taking up old asphalt and disposing of it.

The asphalt is California D grade with a mixture of Cuban, for we find that a mixture of hard asphalt, such as Cuban, adds toughness to the California.

In order to make the asphalt cement mixture, suitable for the different conditions of streets as to sunlight, traffic, etc., a Dow penetrating machine was used.

The sand is tested at the plant by a set of screens ranging from No. 10 to 200 mesh. In order to get a proper mixture and reduce the voids as far as possible and make a good compact mixture and on the grading shown in the sand as taken out of the measuring box over the mixer, depends on the amount of lime stone dust required to make the mixture of the proper grading to carry the required amount of asphalt cement for the service for which it is required. After the sand, stone dust and asphalt cement have been thoroughly mixed and dumped into the wagon, it is tested by what is called the stain test, in which a small amount of the mixture at the proper degree of heat is put between a folded paper and this placed between two boards, which are compressed to make an impression on the paper, and the density of this stain shows the amount of asphalt the minerals are carrying, which we find, should be as high as possible, in order to stand the great amount of moisture to which our pavements are subjected to by continual sprinkling.

MR. OWEN: Now I have also a paper here, which hardly comes under the first part of street pavements, but an interesting paper, and if we have time by and by it will be well to read it. It is "Earth Settlement in City Streets." I will lay it aside, and if you wish we can take it up later. The President has suggested to me, as I am somewhat identified with construction in New Jersey and living there, that I give a little experience of my own on that question, "Highway Construction."

HIGHWAY CONSTRUCTION.

BY JAMES OWEN, MONTCLAIR, N. J.

The subject of highway construction has been so extensively discussed among laymen and engineers that it would seem to be difficult to raise any question that would be novel or interesting in a gathering of

this kind save for the fact that this Society is a gathering of laymen and experts, and probably the laymen would desire to gather data from the experts as his future guide in his official capacity, as to what pavement to use and what to reject, and on what basis his use or rejection should be made.

The assumption of the layman that road construction is a simple mechanical proposition, easy of achievement by an ordinary untrained intellect, while commonly accepted heretofore has been somewhat gainsaid in the last few years as the scattered attempts in this country of road improvement have been a success or a failure in the ratio that a competent engineer has or has not been in control.

The sentiment if the country at large is in favor of good roads. The engineering part in this work has hardly been in proportion to the growth of the movement and the result has been attempts on the part of one man or another to promote his own individual ideas of the work in total disregard of the peculiar requirements of his own locality.

The extent of this country is so great, the supply of road material so diverse, the climatic conditions so varying and the practice of road building so uncrystallized that it is impossible to give hard and fast rules for road construction for any given locality. One expert in roads will tell you that drainage is the *sine qua non* of road construction, but when it is conceded that one-third of this continent is arid or semi-arid, the problems of drainage ceases to be a factor. Another expert will declare that Telford and MacAdam laid down the principles of road construction which cannot be properly departed from, yet if no material of MacAdam's standard can be found within 500 miles, question of economy will put MacAdam into innocuous desuetude.

Another expert has found a natural material in his section that is so applicable to the requirements of his locality that in his broad-minded philanthrophy no other material is of any account or any use.

The fact of the matter is that road construction in the United States has to be developed on its own peculiar standard, which standard will vary in every locality according to topography, climate, geological formation, density of population and the particular requirements of that population. What is a good pavement in one section for climatic reasons may be a poor pavement in another, and what may be proper in one section may be too expensive in another under similar conditions.

The fundamental factors in road construction are as follows:

The earning power of the community.

The topography and climate of the section.

The available road material at hand.

The construction of the road itself.

As to the first, it can be easily seen that in a district with land worth $20 per acre, the paying capacity for road construction is much less than a country worth $100 per acre, the value of the land, of course, being based on its earning capacity, and yet it may be a correct assump-

tion that $20 land might be worth $100 if it had good road communication. However, in the far future when all roads are improved this would cease to be a factor. At the present, however, the taxable value of land is potent in the cause of road construction, as it might easily be seen that a rocky farm, with no possible revenue, cannot be benefited by any road construction at any time. The general community must here enter and announce the plea that intercommunication by good roads is the first law of civilization. If the rocky farm cannot pay for its road the fertile farm beyond must have its means of communication willy nilly.

In considering the topography and climate as functions of road construction, the question of temperature first enters in as the line of frost, penetration in the ground is a vital point in construction. Methods used in road building in a warm temperature will not be found adequate for a cold climate, and coupled with this also enters the question of aridity. where there is no water there is no frost, so the warm area can really be extended so as to include the arid area. In the frost-ridden sections roads have to be constructed of greater depth and of harder material to ensure their stability. To offset this, however, in the extreme North the wear on the road itself is shortened by three or four months on account of snow. Outside of the arid section drainage is paramount. This must be artificial in the flat country and properly graded in the mountain districts. That is to say, water must not be allowed to stand on a flat grade or wash out the pavement on a steep grade.

As to material to be used for roads, the cost of transportation is the prime factor in selection of material and methods of construction. Road materials must be classed under two heads, natural material to be used as found, and artificial material, consisting of natural material broken up to be used. Given a natural substance of average use in an average locality it may be considered economically preferable to an imported material of higher character, but may not give such absolute good results. Good gravel in a well drained country without frost, properly laid and rolled, will give ideal results if properly cared for. If used in the frost limits its period of good use in the year may be extended by putting a layer of larger stone at the bottom.

In some localities there are soft limestones and gravel. The limestone makes a good foundation but does not wear well. Use the stone for the foundation and the gravel for a wearing surface and you will find good results. If no limestone exists then burnt clay can be made available for foundation. If there is no gravel it would then be better to import a hard, durable stone for the wearing medium on the limestone bed.

The slates, shales and the silicates are also available for good road construction. The shales are somewhat affected by frost and require renewals, so it does not pay to import them. The silicates, however, are of different character. Take noviculate, for instance. It is transported

200 to 300 miles with good economic results. Flint formations are also available, but they are rare.

Take the Mississippi Valley in general, however, and what shall be done with its roads? Good material for wearing surface is rare and unsatisfactory, and it is probably best to lay down to the people of these communities to face the music and build their roads in good shape, in approved methods of selected material, transported from a distance and pay their bills. Traveling through the State of Illinois, for instance, what should be done? No local material and poor drainage, but plenty of rich land and rich farmers, so let them pay the bills for first-class roads.

In Alabama, for instance, without better material, not first-class, but available, it would be better at first to make a moderate outlay and then when the farmer gets rich, let him have the best there is. If there is gravel available, let him use gravel for the present; if there is good shale, let it be used, so that the present difficulty of transportation in wet weather may be eliminated.

In all these improvements, however, a trained mind should be used. It need not be an engineer's mind, but it should be an experienced, intelligent intellect, so that any improvements shall have all the up-to-date requirements and no money be wasted.

A first-class pavement designed to use first-class material, prepared in a first-class manner, will be and always has been a failure if carelessly and improperly executed, and we have all seen such cases and know the result. In considering the construction of roads it will not be desirable to go into great detail or lay down any hard and fast rules, as I have found that excellent results can be arrived at in extreme variations of practice and the small final difficulties can only be determined by years of experience, and this final difference may be radically upset by special natural phenomenon for which no foresight can provide.

The following rules, if generally followed, always give good results: Grades must never be level. Minimum, ½ per cent.; maximum light load, 4 per cent.; maximum light load, 10 per cent.

Complete Drainage—Gravel Roads. Gravel with stones about the size of hickory nuts, with coarse sand and about 10 per cent. of loam.

Shale Roads—Gravel and Limestone. About four inches spread, letting travel wear it down. Limestone should be laid like a pavement and properly wedged and the gravel put on and properly rolled.

Telford and Macadam. Telford from eight to twelve inches, with foundation five to eight inches and broken stone three to four inches. Macadam from four to six inches in two layers, well rolled. Top stones well rolled with a final coat of screenings. Broken stone should be uniform in size from 1¼ inches to 1½ inches and properly screened, all dust taken out and put on top.

Character of Stone. 1, trap; 2, granite; 3, hard limestone; 4, soft limestone. In the hard traps packing must be used for proper consoli-

dation. In the granite and limestones the binding can be done without packing. Good rolling is necessary for proper hard road construction. Steam rollers and horse rollers are equally efficacious if consistently used.

After a road is built, the question of repairs immediately enters in. A road just completed may require immediate care. Under any circumstances attention will be required within a year and so every system of road construction that is organized, should be immediately supplemented by a maintenance organization, for in time the construction department will disappear, but the maintenance department will be permanent. At the International Engineering Conference an English engineer told me he had 400 miles of road to be maintained, but he had only built a mile and a half that year. The maintenance department is the vital point in the future of the road development of the country. If roads are built and allowed to relapse, the money is wasted, and the country retrogrades. The stimulus of good roads is marvelous. The bicycle fever was its sequence, and the automobile is now with us. The automobile is growing purely under the encouragement of good road construction and is demanding attention from engineers as to whether there should not be new means and methods for road maintenance. and I will here recite certain investigations to that end.

While the users of the present improved highways, either in carriages, wagons or automobiles, have probably not noticed a more rapid deterioration of the roadways it has become apparent to those in charge of their construction and maintenance that more care and more money is required to keep the surface up to the proper standard; it is therefore obvious that with the probable enormous increase of travel, due to the perfection of surface, other means and methods should be sought that will be more efficacious and also as economical.

Another source of trouble arising from the extended use of the highways is the dust. This is of such extent that it is not only troublesome to the traveling public, but a positive injury to abutting property, whether residential or used for farming. In fact, fruit raising near a much used highway is almost a thing of the past. This dust nuisance has been the cause of recent investigations in Europe for means and methods for its abolition, and it will be in order to give a brief outline of experiments and results.

In congested communities, able to afford it, the past practice has been to use water, by periodically sprinkling it on the surface. This has suppressed the dust, but it has the effect of rapidly rotting the roadway unless extreme care is used in the application. Of later years other material has been used such as tar and crude oil, and in the consideration of these extraneous materials I will give a short outline of what has been done and attempted in Europe and this country.

France seems to have been the first country to consider the subject for in 1880 the engineers at Saint Fay la Grade used tar, but the undertaking was not a success.

In Oran, Africa, in 1898, M. Cardy had some roads oiled with aloe oil and massat oil and the results were so favorable that other towns in Algiers adopted the process. In 1898, however, extensive experiments were begun in California and 80 miles of roads were successfully sprinkled with oil.

In 1900 Engineer Rimini of France prepared a patent mixture of tar with a drier, the mixing being intended to hasten the drying process, but it did not give good results.

In 1901 experiments were made in France with tar and oil, and since then experiments have been conducted in various localities in that country with all kinds of material, especially tar.

The tar manifested such superiority over any other material that it was used exclusively in the further experiments for its practical application. The result of the investigation for proper application of tar in France may be summarized as follows:

The application must be undertaken only in dry weather. The roadway must be perfectly clean, dry and well kept. The tar will not stick if the roadway is damp but becomes loose after a short time.

In cold weather the tar becomes stiff too quickly and does not spread, besides it does not penetrate the surface of the road. If the latter is not entirely clean and free from dust the tar does not cling to it but becomes mixed with the dust when it is spread on the road.

In the application of the tar to the surface it was found that better results were achieved if the tar was heated to a sufficient temperature to enable it to flow freely, about 210 degrees F. Many devices have been originated for properly heating and distributing the hot tar. One, used at Neuilly, consists of a hearth with a tar reservoir over it, and a smokestack to increase the draught. Two kettles are used at one time, so that the tar can be warmed in one while the other is in use. The material is poured into pots with an open spout and poured on the surface. This plant is for a moderate application.

For large stretches a large plant was designated by M. Audoin, consisting of a sprinkling barrel which consists of a cylinder of about two liter capacity which rests upon a two-wheeled truck and filled by means of a pump. The tank is warmed by a portable hearth which is pulled from under the cylinder after the proper temperature has been attained. At the rear of the tank there is, as in sprinklers, a distributing pipe with a number of holes which spread the tar for a distance of five feet. The contents of the tank are sufficient for covering a length of 375 feet. If smaller tanks are used, or even simple sprinkling pots with open nozzles, the tar is spread over by means of broom to ensure even distribution.

In France it was found that before a tarred roadway is given over to traffic it is necessary to sprinkle the tar with a coating of sand. The sand further hardens the tar, protects it and prevents slipping of horses. It was found that the sand should be scattered after the tar has been allowed to harden for two or three days.

Attempts have been made, however. to coat a road with tar and sprinkle it with sand, and immediately turn the street over to traffic. Some of the sections do not seem to wear as well as the sections where the coating was given two or three days to harden. Others wore quite as well in spite of immediate subjection to traffic. To spread over the tar a rather course gravelly sand was used, occasionally fine sand, and here and there the street dust which had been swept together just before tarring. It is to be noted that gravel and gravelly sand gave bad results, for the larger pieces were forced into the tar coat under the action of traffic and made holes. By the use of street sweepings better results were obtained, although this is inferior to river sand. The street sweeping dust absorbs certain lighter parts of the coating. The best sprinkling material is fine sand, which was used on a section in the proportion of about 1cm. to 2,000 sq. meters of tarred road.

It is advisable to stop traffic entirely two or three days during the hardening of the tar. Where this is not feasible and would cause much inconvenience, first one half and then the other half of the street may be tarred. The period of hardening for the tar varies between two and five days according to the temperature, situation of the street (i. e. if exposed to wind or not, the composition of the tar materials, etc.).

By the addition of heavy oils the period of hardening may be lessened. The cost of the tar application in France was found to be as follows: August 1, 1902, a section of road about 370 feet long and 12 feet wide at Champetery was tarred. It had lately been repaired with slag and gravel and was in good condition. Travel was small. From August to November, 1902, the coating wore well, no dust or mud, and the street dried well after storms. From November, 1902, to April, 1903, several traces of wear were discernible, the stones showing through. During a rainy period the tar layer raised in places and formed with the tar remnants which came out at the denuded spots in a thick, sticky slime, which after drying served as a coating. From April to July, 1903, the tar disappeared in places chiefly in the middle of the road.

In July, 1903, the Avenue de la Tourelle in Sainte Mande was tarred. This avenue, which has a very heavy bicycle and automobile traffic, had a limestone surface laid in May, 1903. The tarring was done in July, same year, in damp, cool weather, and the results were excellent. The tar disappeared in places where the surface was not entirely dry when it was applied. This road was retarred in June, 1904, and there was still tar in places although not enough to prevent dust.

These and other experiments show that the tarring of the surface lasts about a year, and during that time there is no dust and little mud. It is, however, the unanimous view of the French experts that the wear of the roadway is increased through the tarring process. This can readily be appreciated since there is little dust and hence less abrasion of the stone. The tar surface is also waterproof and prevents deterioration from penetration of the water.

There is also a strong claim made as to the benefit of tar as a hygenic measure as it has a decided antiseptic action.

In England exclusive use is also made of tar for the maintenance of the surface of the roads and prevention of dust.

In this country the use of tar has become a recognized practice, although at present it is not extensive. One of the first applications was made in Jackson, Tenn., where a very successful experiment was made on practically the same lines as in France. The tar was heated to a temperature of 210 degrees, run over the road through a 1½-inch hose with a one-inch nozzle. The surface of the roadway was then broomed and covered with a light coating of clean sand and screenings and rolled with a steam roller. The cost of this coating was
and lasted about seven months. A section cut through the surface showed that the tar had penetrated one to two inches.

The town of Montclair, N. J., in the year of 1894, coated one of its streets on a steep grade with a mixture of tar and screenings and after a year of use showed little results of wear. At this time patches of the original surface are now visible showing the wear. This year the town has covered about a mile of roads and their surface is universally satisfactory, perfectly clean and smooth with no dust or mud.

The cost of the 3,400 feet treated this year was 30 cents per lineal foot, or 17 cents per square yard. This included 300 yards of cracked stone and screenings and if this item be eliminated from the outlay it will be found that the cost of tarring alone would be about 5.66 cents per square yard, comparing favorably with the French result.

The authorities of the village of South Orange, N. J., are also extensively repairing the streets with tar, with good results, and the Borough of Queens, New York, has also treated miles of its roads in the same way.

There seems to be one radical difference between the French practice and that adopted here. In France they merely sprinkle the surface of the spread tar with sand, especially rejecting gravel as they find the coarse material breaks up the surface of the hardened tar. In this country a coating of screenings is universally spread upon the tar with the design of incorporating as much as possible the tar with the dust.

Taking the practice in this country of using stone dust we find of course a large increase in cost by the extra price of the stone. On the other hand we have the saving of wear on the road itself by the fact that the tar and dust mixture acts as a cushion and lessens abrasion.

While undoubtedly the tar application for highway maintenance seems at present to give the best results, there are other materials now in use that are demanding favorable consideration. The most prominent is crude petroleum. While this medium is undoubtedly best for an arid region like California or Algeria, it has great disadvantages over tar in any territory where there is ample rainfall. It prevents dust efficaciously provided there are constant renewals, from three to four weeks being

seemingly the limit of its usefulness. In wet weather it is objectionable, forming an emulsion with water which has a damaging effect on clothes and the paint of wagons and carriages. It also makes the surface mushy and is objectionable from that view.

A sprinkling material has, however, been invented for use on roads known as Westrumite. It is chiefly a mineral tar, which with the aid of ammonia or other cheap medium is dissolved in water. It is used in a two to ten per cent. solution and sprinkled from tanks in the ordinary way that water is sprinkled. The surface, however, has to be clean. It can be carried on in any weather, except very heavy rain, and requires no interruption of travel. The practice is to undertake the first two sprinklings with a ten per cent. solution and intervals of 24 hours. After that a five per cent. solution every two weeks. The cost for sprinkling with this material for three months, when sprinkling is required, would be about 3 cents per square yard, but this expense is merely for laying the dust and does not obviate the wear as in the case of tar.

There is also a material intended to lay the dust known as Coudrogenit, used in the same way as Westrumite, but its application is limited and correct results have not as yet been arrived at.

In this country a material has been put on the market known as Tarvia, which is being extensively used as the means of allaying dust, and so far its application fills the want for immediate delivery of a tar preparation for road surfacing.

Whether in the larger use of tar in the future its market price will be as economical as the use of ordinary coal tar is a fact that remains to be proved.

Tar as a medium for binding stone is no recent innovation. Years ago tar pavements were in great demand and use, and some of them are in existence to-day, but the knowledge of its use and properties is much more intimate than it was at that period.

MR. OWENS: . One of the live subjects to-day is what is known as Bitulithic Pavement. The following paper gives a description of it:

BITUMINOUS PAVEMENTS CONTAINING CRUSHED STONE.

BY J. W. HOWARD, C. E., E. M., CONSULTING ENGINEER ON ROADS AND PAVEMENTS, NEW YORK.

INTRODUCTION.

The object of this paper is not to advocate any one kind of pavement—granite blocks, asphalt, bitulithic or other kind—nor to make comparisons between them. In my professional work in connection with pavements, whether testing their materials in my laboratories, preparing

specifications, or inspecting pavements during or after construction, it is my duty to help secure the best materials desired or available in each locality and use them in the best ways.

During the past twenty-five years, among many kinds of pavements I have investigated in the United States and foreign cities, none has had such rapid rise as a relatively new type of pavement. The present use on the streets of about one hundred and fifty cities of monolithic pavements, containing crushed stone in the wearing surface, makes them worthy of careful investigation.

I will not dwell upon the many local conditions which affect all kinds of pavements, such as climate, wet, dry, hot, cold; traffic. heavy and light vehicles, quantity of vehicles and horses; width and grade of streets; cleanliness or lack of it; good methods of cleaning or those injurious to pavements, as flushing with water under pressure; and other conditions, not only for each city, but each street in a city. I will assume that these factors of the paving problem have received proper attention for each street.

I will omit reference to tarring, oiling, or other methods of dust reduction and semi-waterproofing of suburban macadam and other roads, as a branch of the subject requiring special treatment, after the present experimental stage has been passed. I will confine the attention to bituminous pavements for cities.

Sheet asphalt pavements do not contain artificial crushed stone. They are made either from natural bituminous limestone, ground and compressed as in Europe and a little in America, or are made from a mixture of sand, dust and asphalt-cement, as in American cities. Asphalt pavements are a group by themselves, some of them being valuable for city pavements, as I have endeavored to describe in previous addresses before our society.

The binder course contains crushed stone; but the binder is between the foundation and the wearing surface and does not come in contact with traffic. This binder under asphalt and in certain cases under bituminous pavements containing crushed stone, should be a close, dense and waterproof mixture, thoroughly compressed, as now prepared and used more and more, as cities learn the durability and ultimate economy of using close binder, instead of the open, loose binder which permits water to percolate through it, coming from joints at curbs, rails, manholes, etc. This water injures the foundation below and in many cases the wearing surface above the binder. This is taking place on hundreds of miles of streets, paved with asphalt, especially the kind easily injured by water. But binder, not being exposed to direct traffic and weather, does not need our further attention.

Asphalt blocks, as made in America, are practically crushed stone, sand and dust, cemented together with bituminous cements. They are relatively little used except in a few cities. Not being monolithic pavements, I will omit further mention of them.

FOUNDATIONS OF BITUMINOUS PAVEMENTS.

The various foundations for bituminous pavements need special constructions. The subsoil, as for all pavements. must be properly graded, compacted and securely retained at the sides by curbs or otherwise.

If a new foundation is to be laid, it can be either the bituminous base or hydraulic cement concrete base. Whichever used must fully sustain the very heavy steam roller needed to properly compress bituminous pavements of crushed stone. If these foundations sustain this test, there is no need of making them of undue thickness, and, therefore, excessive cost. If the subsoil is well drained and of a firm character, as when composed of stones, gravel or loam, mixed by nature or otherwise, then the bituminous base is of advantage to be used under bituminous pavements. The bituminous base is composed of suitable, coarse, crushed stone which should be compressed with a steam roller of at least ten tons. The surface of this base is coated with a suitable bituminous cement applied hot, letting a little surplus run down a short distance into the upper portion of the crushed stone. The bituminous base will adhere firmly to the wearing surface mixture when that is laid, and prevent displacement or rolling of the wearing surface into depressions and ridges. Bituminous foundations have been successful for various pavements in Europe and America for about thirty-three years and are being rapidly adopted everywhere. Another advantage of the bituminous base is the ease of access through it to pipes below the street, combined with rapid repair over such pipes.

If the subsoil of a street is yielding or poorly drained, a foundation of hydraulic cement concrete should be used. Care must be taken to make the surface of this concrete rough, to prevent the bituminous pavement from slipping on it and forming depressions and ridges. The simplest and best method now used is to make the concrete slightly rich in mortar, then tamp it until a film of mortar is on the surface of the concrete and immediately scatter over this surface a sufficient quantity of clean, broken stone, of about one and one-half inches in size, to half cover the concrete, and at once tamp the stone, about one-half the depth of the pieces, into the film of mortar and surface of the concrete. These stones will then form keys or teeth projecting into the under portion of the wearing surface when it is laid. This makes a dense, strong concrete foundation, having all voids filled with mortar, and provides a rough, serrated surface, suitable for all kinds of monolithic pavements. This method of laying concrete foundations is more and more used everywhere. It should be required in all specifications for the use of bituminous pavements.

There are several weak and bad forms of hydraulic cement concrete foundations which must be guarded against. Avoid concrete lacking sufficient mortar to fill the voids between the stones. Some contractors lay such concrete not only to save cement, but for the alleged reason of providing a rough surface for retaining asphalt and other sheet pave-

ments from slipping. This not only gives a weak foundation, but permits water to easily penetrate the concrete from below, as on many streets of Buffalo and other places, to the great injury of the wearing surfaces which are thereby often disintergrated or at least displaced by alternate thawing and freezing of the water. The concrete itself suffers by the same actions.

We must prevent a concrete foundation from being roughened on its surface by the bad process of only partly tamping the concrete and thereby only partly displacing the mortar of the concrete and not forcing it up into all voids from its original position in the lower portion or bottom of the mass, which it may take at first. This partial tamping may leave projecting stones at the top of the mass, but such incomplete tamping leaves voids in the concrete. The resulting foundation is not uniform, dense, waterproof, strong nor durable. The surface is not uniformly roughened, but consists of holes and bunches with projecting and loose stones all over it. Thorough tamping is what all engineers insist upon. The evidence of such tamping is a slight excess of mortar forced to the surface of a concrete.

There is another group of foundations which are successfully used with great economy under bituminous pavements. This group consists of old pavements prepared in several ways.

If the old pavement is sheet asphalt, asphalt blocks, brick, stone, wood blocks or other pavement with a firm foundation of concrete, crushed stone or their equivalent, the best way is to remove the old pavement down to the upper surface of the fundation. Then, if needed, build up the foundation with a bituminous base of at least three inches thickness, laid as already described. But when there is not room for this, then lay a dense binder of not less than one nor more than three inches thickness. The bituminous pavement wearing surface is then laid upon the foundation, built up in one of the two ways just described.

If the old pavement is of brick, cobble or stone block, and at the same time sufficiently low to permit being surfaced with bituminous pavement, these old pavements can be used for a foundation by having the blocks and the joints between them well cleaned. A binder, such as I have described, is then laid over the old pavements, to a sufficient height to leave two inches for the wearing surface.

If the old pavement is macadam at a height, thickness and quality suitable for a foundation, it can be brushed clean, built up to the grade desired with clean, crushed stone. This new surface must be rolled with a very heavy steam roller, then coated with a suitable bituminous cement. The old macadam thus becomes a bituminous base.

The foregoing briefly describes the best methods in general, successful use, for preparing foundations for bituminous pavements. There are others, some very complex and expensive, with no advantages over any of those described. There are still others which are positively bad in principle and worse in practice; for example, coating the surface of a

hydraulic cement concrete foundation with a bitumen. This has been tried and is a positive detriment; among other reasons because the bitumen cannot run down into, but gathers in small pools on, the concrete. It soaks upwards and softens many spots of the wearing surface, causing the pavement to wear unevenly as well as to slip on the bitumen, softened by the heat of summer. The surface of a hydraulic cement concrete should never be coated with bitumen, whether asphalt or other bituminous cement. It is also a useless expense. A concrete foundation can be made strong and with a rough surface by the method of thorough tamping I first described.

WEARING SURFACES OF BITUMINOUS PAVEMENTS.

The upper layer about two inches thick, being subjected to the direct wear of traffic and weather, is called the wearing surface. Let us consider some of the essential principles needed for the construction of successful bituminous pavements containing crushed stone.

A brief glance backward shows how new this general kind or type of pavement is. Although there had been earlier attempts in England and France, it was not until about 1880 that a small amount of roadway was surfaced with definite, experimental mixtures of crushed stone, pitch and tar. This was in Europe, as well as the later experiments of mixing crushed stone with rock-asphalt in Germany and France, with the hope of making the asphalt pavement less slippery.

Several attempts were made in America of laying mixtures of stone and gravel with tar and asphalt. They were nicknamed "poultice pavements" and failed. About 1899 the late F. J. Warren began to investigate compounds of stone and bitumen, to learn the causes of previous failures and how to succeed. He made a distinct advance in this art. What is known as the bitulithic pavement is the result of his researches. He invented some new machinery and process and mixtures, and insisted upon certain qualities of the crushed stone and bituminous cements used. Therefore, the pavement laid under his formula is thus far the best one of the general group of crushed stone bituminous pavements. The success of his special pavement has naturally caused great efforts, not only in the United States, but in several foreign countries, to either imitate it or evolve a substitute; especially because his machinery, processes and mixtures are patented or protected by trade-mark and copyright. The present results of imitating are patent lawsuits. Substitutes are thus far not successful, although a great improvement over previous practice.

By whatever process produced, a bituminous crushed stone pavement, to be successful, must meet the following requirements: It must have maximum density with minimum voids; the stone used must be durable, to resist wear; the crushed stone so proportioned in a descending scale as to have each successive smaller size fill the voids between the larger sizes down to the finest powder, and have these stones mutually support each other; then a cement must be used which is waterproof, adhesive and

ductile, not only to cement the mineral aggregate together, but also to fill any possible tiny voids; this is best accomplished by pre-separating the crushed stone into several sizes and storing them in several bins, then taking such proportions of each size from each bin as have been found by technical tests to give a mixture of the greatest possible density of the kind of stone used, or a density as near as possible to that of the original stone from which the crushed stone was made. The result is easily demonstrated by comparing the specific gravity of the stone before it is crushed with the final aggregate of crushed stone. It is not possible to obtain a maximum density by using crushed stone direct from a crusher; nor by filling its voids with some small sizes which are not graded; nor by filling the voids with a mixture of sand and stone dust. Comparisons of the different weights of, say, one cubic foot of each of these mixtures, show at once the lack of weight and consequent lack of density of all mixtures which are not made on the principle of assembling the crushed stone in graded sizes from the largest to the smallest particles. I have examined bituminous crushed stone pavements of several kinds in many cities, some using mixtures on the principle I first described, and others on the other methods I have referred to, and found the above facts to be borne out in practice.

Without going into technical details of the bituminous cements used, I can suggest some of its requirements. It must be uniform as shown by penetration, flow, evaporation and other tests. It must be soft and vicious as possible and still have adhesion and strength sufficient to bind the mineral aggregate together at all weather temperatures, and when subjected to the shock of wheels and hoofs. It must not be volatile at the temperatures used in mixing, which, of course, cover weather temperatures. It must resist water action and be ductile and flexible, as well as remain adhesive at the extremes of winter and summer.

A crushed stone bituminous pavement, when finished, should have a granular, rough surface, so as not to be slippery for people or horses, and to prevent the skidding or sliding of vehicles sidewise. This is very much appreciated by owners of automobiles. It will have this surface composed of as much angular stone as possible to be compressed together.

A special surface finish is applied to the best pavements of the type we are considering. It consists in applying a thin film of a suitable, soft, quick drying bitumen, applied hot, and then spreading on it a thin layer of very fine stone grit. The function of this process is to seal any pores which may exist on the wearing surface, and still leave the surface roughened.

I will close by briefly indicating what must not be done and what I have observed produces weak crushed stone bituminous pavements, which do not give maximum service for minimum cost of construction and minimum subsequent maintenance.

Stone, as I have indicated, as it comes from the crusher is called "crusher run" stone. This is not suitable for making the densest compounds. The different sizes of the crusher run stone are not in the right proportions to reduce the voids to a minimum; nor is such crushed stone constantly uniform in its composition of sizes or arrangement of sizes, even from the same quarry. The use of crusher stone is one of the causes of failures of the pitch and tar macadams of the past which were laid for experimental or other reasons, and are still laid to a limited extent in a few small places.

A very few attempts have been made to construct a pavement of the general type we are considering, by combining crushed stone containing say 30 per cent., or even 20 per cent. of voids, with a bituminous mastic or an asphalt paving mixture of sand, dust and asphalt or other bituminous cement, relying upon this bituminous mastic or mortar to fill these voids in the crushed stone. Such pavements might be called asphalt filled stone or stone filled asphalt pavements. They have not the best qualities of either. Their greatest defect is that the stone ingredients do not interlock and mutually support each other, but are kept apart by, or are suspended in, the yielding bituminous mastic or mortar.

A somewhat similar process was tried in Germany and France and is now being tried, to a limited extent, on a few roads outside of cities. The process I refer to is the use of crushed and ground natural bituminous-rock, called rock-asphalt, as a filler or binder for ordinary macadam. This has not been found economical in Europe, but it may meet with better success under light traffic on country roads where it can be obtained cheaply near the quarries of rock-asphalt.

There are other processes which are impracticable in theory and practice, although they are sometimes described in print, by men who would like to get them tried at public expense. They generally advocate using crusher run stone, mixed with sand and bituminous cement, or with semi-liquid bituminous mortar and then relying upon tamping and rolling to produce a pavement having its voids filled from pressing the mastic or mortar into the voids.

Such pavements do not contain sufficient stone, nor the right proportions of all their ingredients. They produce cellular pavements, with the cells filled with weak, pliable material. They violate the standard engineering principle that wearing surfaces, subject to shock, rolling and other friction, must not have irregular densities. A successful bituminous pavement of the crushed stone type must have all the stone possible concentrated in it, so as to present a maximum resistance to wear, and the bituminous cement must be of right quality and used only in sufficient quantity to cement the mineral aggregate together, fill any interstices and make the pavement weather proof.

THE PRESIDENT: There is an announcement to be made about the photos taken yesterday.

PHOTOGRAPHER: Gentlemen, I want to say in regard to the photos we made on the trip are not ready yet, but are excellent. I have a very good negative, and the photos will be finished in 11x14 mount on 16x20 card and will be sent to your address prepaid at $1.25. Now if any of you gentlemen want one, I will be in the hall and on leaving, you can leave me your name and I will forward them to you.

MR. OWENS: Mr. Chairman, there is another paper here from Helena, Ark., about the Oiling of Public Roads, in that city, and I suggest as the time is short that we read it by title and incorporate it in the minutes if there is no objection.

AN EXPERIENCE IN OILING AN UNPAVED STREET.

BY FRANCIS H. WRIGHT, CITY ENGINEER, HELENA, ARK.

The writer does not care to pose as an expert on the use of oil for road purposes, for he is none such, but being anxious to contribute something to the success of the Birmingham meeting, he has assembled a few facts gained from an experience of his own, during the past summer. Every city engineer, especially in a small city, has the usual experiences of dealing with "natural-born" engineers amongst the representative citizens, and there are times when they become quite troublesome. We have a few in our little city, and last summer one of them who had been reading one of the "Good Roads" or something similar circulars found out that they were improving the roads in California by the use of oil upon them.

He was very restless until he had button-holed the city engineer, the mayor and the chairman of the board of public works, and after putting them on the "inside" he induced them to assemble in front of his house where he was able to deliver a "good roads" speech to them in a body. His honor knew that there was so much work to be done around the city and so little to do with, that he was reluctantly persuaded to enter into an agreement with the enthusiastic citizen that the city would bear the other expenses incident to the oiling, if the property owners would pay for the oil for the street.

The city engineer knew that he had no means for handling or storing the oil and that there was considerable other work necessary before the street would be in any condition to oil.

For that reason, he was inclined to dodge, as he also knew that he would not likely get funds enough to do the necessary grading, etc. However, the car of crude oil was ordered, so now the story begins: The street had had some work done on part of it the preceding spring

(there were two blocks, about 700 feet in all) and the upper block was a good crown on about a six per cent. grade, and the lower block was a much flatter crown, dropping off on the upper end from the upper block on about an eight per cent. to about one-half way down, then about a four per cent.

There was a total rise of about forty feet in the two blocks, and in heavy rainstorms there had always been very much washing of the gutters and in the wagon tracks on the crown, as the soil was a very soluble yellow clay, Helena being the termination of Crowley's Ridge, which is well known to engineers and geologists of the Mississippi Valley. The street was thoroughly plowed twice for a width of forty feet, the amount used for traffic, the plow being a small pointed Avery with a steel beam, which cost $10 in a local hardware store.

After plowing, a disc harrow was thoroughly applied, after which a toothed harrow was used until the whole street was like ashes. One team only was used on this preliminary work with a driver, but a shaker was used with the plow.

The plowing and harrowing consumed about two days' time.

There was some scheming necessary in order to get the oil from the car. It was thought at first that the gasoline pump in use by the local oil depot would answer the purpose but it was found to be impracticable on account of the waste in frequent startings and stoppings in loading into separate barrels at each trip of the wagon, there being three 52-gallon barrels upright in the wagon-bed.

A small lever pump was bolted to the floor timber of the car at the side of the tank, and a connection was made to the inside of the tank by a siphon through the dome of the tank, made of two-inch wrought iron pipe with the necessary fittings.

The driver with one man to pump was able to leave the street, go to the car and fill his barrels and return in exactly thirty minutes. A strip was taken on one side of the street about fifteen feet wide (the street not being closed from traffic), and three men, each armed with a large two-gallon garden sprinkling can, with spray removed, poured the oil on the pulverized surface, each man working in his own section, about twenty feet long, the driver filling the sprinklers by pumping from the barrels with a tin oil pump.

The writer inaugurated this system of distributing oil during the mosquito campagn of the previous year (1905) and found it very satisfactory.

A load of coarse sand was dropped about every fifty feet on the oiled strip, and during the absence of the wagon in refilling the barrels this sand was spread by the men in the same manner that sand is applied over a newly grouted brick pavement in thin layer.

After one side was oiled and sanded, a strip on the other side was treated likewise, and the center strip was again plowed and harrowed (having become compacted by traffic) and also treated, after which the

whole street was run over with a toothed harrow, and was then gone over and oiled and sanded a second time but was not harrowed. The street was then thrown open to traffic.

This was all done the first week in July, and until recently, there has been comparatively little dust, and no mud, nor has there been any more washing where formerly it was excessive after a hard rain, and we have had several this summer, one quite soon after the street was treated. I am of the opinion that the oil should have been renewed within sixty days. We were, I think, fortunate in having rather hot weather in which to apply the oil. The gutters have still a good percentage of the oil retained, and the sod was enabled to take a good set, which, of course, reduces the wash.

Time was taken in unloading one wagon (three 52 gallon barrels), and it took three men exactly one hour to dispose of the load over a surface of 15 by 100 feet, or 1,500 square feet.

One man scattered with a shovel one wagon load (about 24 cubic feet) of sand over an area of 50 by 60 feet, or 3,000 square feet in fifteen minutes. The cost was as follows:

(The oil was charged at $1.59 per 44 gallon barrel.)

Team, 7 days at $3	$21 00
Labor, 11 days at $1.25	16 75
Foreman, 3½ days at $1.50	5 25
Total labor account	$43 00
Oil, 47.14 barrels at $1.59	$74 95
Sand, 35 loads at 75 cents	26 25
Total materials	$101 20
Total, all items	$144 20

I thank you, gentlemen, for your attention.

THE PRESIDENT: The next paper on the program is on "Paving and Paving Materials of the Southwest," by Mr. Reichardt, of Little Rock, Ark.

PAVING AND PAVING MATERIALS OF THE SOUTHWEST.

BY WALTER F. REICHARDT, LITTLE ROCK, ARK.

Owing to the many kinds of pavements in use and the vast amount of paving material found in the southwestern states, the writer will be compelled to describe each in brief manner and will not go into detail in discussing the specifications but will endeavor to give to this Society the results of investigations and tests of the quality and properties of

paving materials as found in these states and the various methods of construction of pavements made of these materials. This discussion will deal mostly of pavements in use in cities ranging from 10,000 to 50,000 population, as this size city is the one mostly found in the above states and is one with which most engineers come in contact.

The most common pavement found in the southwest is the brick pavement, and on account of the various grades of material used and the different methods of construction this pavement is very interesting and will be given first discussion.

Paving bricks are manufactured in a number of cities of the southwest, but the best grade comes from Kansas and Arkansas, the former being the better brick. In the City of Pittsburg, Kan., there are two companies making paving brick, and while both are made in the same city and in practically the same locality, almost an entirely different grade of brick is obtained. In the manufacture of paving brick, as in the construction of the brick pavement itself, different results are obtained with the same materials, due to the difference in handling same. In the case of the Pittsburg brick, one is soft and does not stand wear at all, while the other is hard and absorbs but little water and stands traffic very well.

The writer has found the methods of construction of the brick pavement to be of more interest than the manufacture of the brick itself, and will show how different are the ideas of engineers and city officials in various localities and the results obtained.

In the State of Arkansas, where the writer has practiced mostly, the brick pavements have been constructed in the past on a very cheap basis. In most cases no foundation other than the natural earth has been used. In the City of Little Rock two brick pavements were constructed about fifteen years ago, on a clay or natural earth foundation and remarkable results have been obtained. In the construction of this class of pavement the subgrade was prepared just as though a concrete foundation was going to be used. After the subgrade had been properly rolled, a cushion of sand about 1½ inches was spread on top, after which the paving bricks were laid on edges and the joints filled with sand.

In the case of the above city these two pavements have given excellent results and it is doubtful if the other brick pavements in that city constructed on concrete foundation will give much better ones. In the City of Fort Smith, Ark., where one of the largest contracts ever let for paving at one time, the pavements in most cases will be brick and will have no other foundation than the natural earth with a four-inch sand cushion. The bricks will be laid on edges and will be thoroughly rolled with a heavy roller. The price for this class of pavement was 83 cents per square yard, which is exceptionally cheap for any kind of pavement.

Another method of constructing brick pavements that has struck the writer very forcibly as being one of the best, if not the best method, is

that one that is in use in Pittsburg, Kan., and is one with which the writer has had some experience while city engineer of that city.

I have been informed that this method has been used by other engineers and has given good results. In the construction of this class of pavement the subgrade is prepared in the usual manner, great care, however being taken to remove all soft and spongy places and refill same with good material. On top of the subgrade is spread a four-inch layer of cinders which are sprinkled and thoroughly rolled with a roller weighing not less than five tons, after which a layer of hard burned vitrified brick is laid flatwise and close together, with the long edge parallel to the curb line. Then on top of this platen course of brick is spread a one-inch layer of sand which is shaped to the finished contour of the pavement by means of templets making the pavement ready for the top layer of brick or wearing surface. The top layer is composed of the best hard burned brick and the bricks are laid on edges with a sand filler.

After the joints have been filled with sand a thin layer of sand is spread over the entire surface. In rolling the top layer a roller weighing not less than five tons is used and that part of pavement that cannot be rolled is thoroughly tamped. The contract prices for this class of pavement, as was paid on the construction of two large districts, were $1.20 and $1.26 per square yard.

In the opinion of the writer this method makes an excellent pavement, and judging from one of these pavements that has been in use for more than fifteen years in Pittsburg, this pavement will last as long as any other kind of brick pavement. Owing to the fact that this pavement can be constructed at such a small cost and that it is not near so noisy as the brick pavement laid on concrete foundation, this method of construction will become very popular in this section, especially where brick can be secured at a reasonable cost. When the top layer or wearing surface becomes worn, the old layer can be replaced by a new one without disturbing the foundation or platen course.

The method that is perhaps most used in the larger cities and that is being used to some extent in smaller ones also, is the laying of brick on a concrete foundation with sand cushion.

This method is more costly than any other both from the cost of material and supervision necessary to secure good work. The subgrade is prepared in the same manner as in the above methods and a five-inch layer of concrete is laid for the foundation. This is generally mixed in the proportions of one part Portland cement, three parts clean sharp sand and five parts crushed stone, the largest of which will pass through a 2½ inch ring. On top of the concrete is spread a cushion of sand varying from one to two inches in thickness, after which a layer of hard burned paving brick is laid on edges and then thoroughly rolled. After rolling, the joints are filled with cement grout, pitch or asphalt filler.

The writer seems partial to the pitch or asphalt filler, as the pavements which he has investigated and are filled with cement grout, appear

to be very noisy pavements. The cost of this class of pavement, where crushed stone is plentiful, varies from $1.80 to $1.90. However, in Fort Smith the price was $1.46 per square yard.

In the construction of brick pavements under the last method the writer found that great care must be taken both in selecting the material and supervising the actual construction in order to obtain a good pavement, and found in some instances where the specifications had not been properly carried out and that the surface of the concrete foundation was not of the same contour as the finished pavement. This latter defect being due in a great measure to carelessness on the part of the engineer who probably did not give sufficient grade stakes or else did not see that the work was not carried out according to the stakes which he had given. Another error often found in this construction is that a proper cushion joint is not left next to the curb, and as no allowance is made for expansion, the pavement raises or cracks in the center. This is also very noticeable where brick is laid between car rails.

A pavement that is becoming more popular in the southwest is the asphalt pavement and this is due to the fact that a very fine grade of rock asphalt has been found in these states. Of asphalt pavements now being laid, rock asphalt seems to be in the majority, as it has been shown that this grade will stand the warm temperatures.

The rock asphalt is found in large quantities in Arkansas and the Indian Territory, the former being richer material, and the writer believes will stand more wear. The Territory asphalt has been used a great deal in Texas and has given good results, while the Arkansas material has been used only in that state.

The rock asphalt pavement is constructed in same manner as the old asphalt pavements with the exception that a binder course is not used. The asphalt is ground, after which carbonate of lime is added and the mixture dumped into a mixer. After the material has been thoroughly mixed, it is shoveled into the heater where it is raised to a temperature of 250 to 300 degrees F. It is then hauled to the street where it is raked and rolled as in any other asphalt pavement.

In the mixing of rock asphalt great care must be exercised as the material as a general rule runs irregular in percentage of bitumen and therefore requires constant testing in the laboratory. The amount of carbonate of lime that is added to the mixture of course depends upon the percentage of bitumen that the material contains. The writer has used the Territory, Arkansas and also the Kentucky asphalt and finds that a good pavement can be had from use of each kind if it is properly handled and that no fixed rule can be applied the handling of any as constant experimenting and testing of each is required. Of the three asphalts mentioned the writer has found the Arkansas material which is the richer material, to be the easiest handled and owing to its large amount of bitumen is exceptionally good for the asphalt macadam.

The asphalt macadam has become very popular and owing to its small cost as compared to the other pavements will become more popular and will be used extensively in residence districts. An asphalt macadam has the same appearance as that of the sheet asphalt and is as easily kept clean, its surface being smooth but not slippery.

The Arkansas Rock Asphalt Co.'s macadam with which the writer has had experience is constructed as follows: The subgrade is prepared in the usual manner, however great care is taken in removing the spongy places and refilling with good material and is thoroughly rolled. On top of the subgrade is spread a 3-inch layer of stone, the largest of which will pass through a 2½-inch ring. This layer is then thoroughly rolled after which a one-inch layer of sand is spread and rolled thereby filling to a great extent the voids of the stone. On top of the sand and stone is placed another three-inch layer of stone, of the same size as base material. The entire pavement is again rolled and is then ready for the wearing surface, which is three inches in thickness and consists of a mixture of ground rock asphalt and crushed stone, the largest of which will pass through a one-inch ring. After this mixture has been spread the entire pavement is again rolled with a heavy roller, and after sprinkling or sweeping cement over same the pavement is ready for traffic. This pavement increases in hardness by the traffic as it becomes more packed.

The cost of this pavement in the City of Little Rock where crushed is plentiful, was $1.40 per square yard.

This macadam is not an experiment, but has been proven to be a popular pavement as well as a lasting one. However, this like all other pavements requires attention and must be kept clean as we all know water and filth causes deterioration of any pavement.

An advantage that the macadam has over the sheet asphalt pavement is that it is not slippery, and never becomes so, the stone in the pavement affording a footing for the horses.

Another pavement used to some extent in the above section is the bitulithic, and like all other pavements has given both good and bad results. In the business districts of some of the old cities we find the granite block pavement which, in most cases, have been down for years and are still good for many more years. This class of pavement is intended for streets over which there is traffic of heavy wagons and therefore should only be in wholesale districts. This pavement is as much out of place on a main street where there is traffic of light vehicles only, as an asphalt pavement would be at a wharf or in a wholesale district where the calks on the mule's shoes cut and wear the pavement in a few years. The writer is of the opinion that the cities in this section now having the granite block pavement will replace same with asphalt or some other good pavement, excepting where the granite is in wholesale districts.

The wooden block pavement has been used in but very few cities and in some cases have not proven a success, but if the blocks now being laid in the East were used this pavement would become very popular.

As a general summary the writer will state that paving has to a great extent been neglected in the Southwest, but that more work has been done in this line in the past three years than any time previous and that with the good roads movement on throughout all sections of the country, there will be greater activity in street paving throughout, and no city can become great without good pavements, as good streets make any city.

Have also noticed that most of the cities are without street cleaning departments and that the streets are practically neglected and are not kept in a good and sanitary condition. This perhaps more than any other cause is the reason why so many pavements fail and do not meet the requirements. For this reason asphalt pavements have not been used as much as other pavements as this pavement must be kept clean and sanitary to give good results.

Owing to the large amount of oil in the Texas fields the use of oil on macadam roads has become popular and is used a great deal and with good results in small towns where the more costly pavements can not be laid. Chert and trap rock are found in Missouri and Arkansas and are excellent materials for macadam.

The writer has endeavored to show the Society and especially the members of the Northern and Eastern states the many methods used in constructing pavements in the Southwest, and the vast amount of paving materials to be found in this section and hopes that it will bring out discussion by which the Society as well as himself will profit, and it is to this end that he has presented this paper.

THE PRESIDENT: We have one more paper on the Tests of other woods than yellow pine for block pavements by Mr. Kummer, New York.

MR. KUMMER: I think in as much as it is so late it would be well to read that paper by title.

THE SECRETARY: I think we would like to hear that paper.

TESTS OF OTHER WOODS THAN PINE FOR PAVING PURPOSES.

F. A. KUMMER, 29 BROADWAY, NEW YORK, N. Y.

The increase in the price of long leaf yellow pine since the year 1900, at which time the company with which I am connected first began its purchase for paving block purposes, has been quite 50 per cent. I remember distinctly buying five and six years ago large orders of one million feet or more of all heart, long leaf, Georgia pine at considerably less than $20 per M. delivered at New York, while inferior grades of lum-

ber to-day command a price of about $30 per M. It will readily be seen that a difference of $10 per M. feet adds 36 cents per square yard to the cost of 4-inch block. Wood pavement being already the most expensive pavement in the market—at least so far as first cost is concerned, this heavy increase naturally to some extent has limited the market for this character of pavement. Not only has this been true so far as price is concerned, but the quality of the lumber obtainable has also decreased. Five and six years ago the material which we purchased for paving block purposes was cut from the best part of the tree and was dense, solid lumber, usually cut from trees of fairly large size. The lumber we get to-day contains a small proportion of sap wood, which is undesirable, and is usually cut from the tops and smaller parts of the tree and from smaller trees; and for this and other reasons is less dense in quality and requires more care and expense in treatment to bring it up to the standard which is called for by the best specifications. Appreciating these conditions, not only individual manufacturers of wood block, but the Bureau of Forestry of the Department of Agriculture have been conducting tests to determine what other woods of those available in this country can be successfully used for paving block purposes. The first test of this character of any size was arranged between three parties, viz.: The Department of Agriculture, the Kettle River Quarries Company of Minneapolis, who are manufacturers of wood block, and the City of Minneapolis. Without going into the exact details of this test it has been arranged to lay a section of pavement in Minneapolis upon which the several kinds of wood are to be tested in comparison. Among these are Norway pine, which has been extensively used in that part of the country for street paving work, and tamarack, which has had a much less extensive use for this purpose, but promises excellent results. This test, which is to be made on a heavily traveled street, should show much both as to the quality of these woods and the best methods of laying them—as in the test different forms of construction will be used. The writer does not feel at liberty, however, to go into a description of these tests at any greater length, as in advance of the results which the parties at interest may have to give out it would not be proper to do so.

Early this year the same arrangement was suggested by the Department of Agriculture, Bureau of Forestry, with the U. S. Wood Preserving Company and the City of New York, the purpose being to test against long leaf yellow pine not only short leaf pine, but tupelo, loblolly pine, maple, sap gum, scrub pine and scrub oak. This test was to be somewhat similar to that made in Minneapolis, although embracing different varieties of wood and a different arrangement of the variables which could affect the construction; such, for instance, as the question of laying blocks on sand cushion or mortar bed; the best form of joints to be used between them and whether the blocks give better results laid straight across the street or laid at an angle with the curb. The arrangements for this test have not yet been perfected, although this is not in any way

the fault of the City of New York or the Department of Agriculture, but is due to delay on the part of the wood block company, who are not yet quite ready to undertake the experiment as proposed, pending other tests which are now being made. The writer has some doubts as to the value of tests on scrub oak, maple and some of the other woods named, as it is questionable whether they could be secured in large quantities, commercially, at reasonable prices—although in this respect there seems to be a confliction of opinion.

There is one wood, however, with which we have made some extended experiments in New York City with very satisfactory results. This wood is what is known in the South as black gum. The source from which we are now obtaining it is Norfolk, Va. and vicinity, but it no doubt exists in other localities in large quantities. Unlike red gum, it has not been particularly valuable for any general use, owing to its very irregular and crooked grain and the difficulty of properly seasoning it. One city block between the tracks of the Metropolitan Street Railway Company on Hudson street, New York, was laid with this pavement about a year ago. The joints between the blocks were filled with paving pitch. They were laid on a cement mortar bed on concrete, as usual. They have given perfect satisfaction in every respect, have shown no tendency to swell and have worn, if anything, even better than the pine in the adjoining track. This wood. which is materially cheaper than pine and promises to remain so, possesses some advantages as a paving material and some disadvantages. Among its advantages may be named its extremely tough and close grain, making it not only a very durable block, but also one which does not split readily. This is an enormous advantage to the manufacturer as waste in cutting, handling and shipping pine blocks is extremely large. Among its disadvantages may be named its greater weight in shipping, the greater length of time required to prepare it for treatment by driving off the contained moisture, and the fact that when this moisture is driven off the blocks require a greater amount of preservative per cubic foot to thoroughly impregnate them and fill up all the pores.

This wood is now allowed in the specifications of the boroughs of the Bronx and Queens in the City of New York, as an alternate for pine, and the U. S. Wood Preserving Company has recently taken the contract to lay a street containing somewhat over sixty thousand square yards with this wood in the borough of the Bronx. Large shipments have also been made to Bridgeport, Conn., to Holyoke, Mass., to Springfield, Mass., for the main street there, and to Boston for the Boston Electric Railway for track work on Beacon street. Lexington avenue, New York City, from Forty-second to Seventy-second streets, between the tracks of the Metropolitan Street Railway Company has also just been paved with this material, and sixteen thousand square yards are now being shipped to Boston for street work. A contract has also been let to lay this wood on Green street in Baltimore, Md. The specifications of the City of Cincinnati also

permit the use of this wood as an alternative of pine, as do also those of a number of other places which I will not now mention.

The writer enumerates these examples of the use of black gum to show the very large extent to which this wood is now being used, a fact which no doubt will be new to you all.

In any determination as to the value of a wood for paving purposes, if we start with the assumption that by filling the pores of the wood throughout the block completely with a good quality of creosote oil, decay can be prevented. There remains only one other question to be decided and that is whether the wood is sufficiently dense, tough and hard to successfully resist heavy travel. Such a determination is not a very difficult matter. In fact, it is almost self-evident that using Georgia pine as a standard, any block which is as hard or harder than this wood should give equally as good or better results, while those blocks which are not so hard—such, for instance, as short leaf, loblolly and Norway pine should give less satisfactory results. The writer believes that all these woods can be used for paving purposes if properly treated, but should be used with discrimination. A street laid with loblolly pine under moderate travel might readily give a serviceable life of twenty years or more, while a similar pavement under the excessively heavy travel found on such streets as exist in the lower part of New York City would probably be destroyed very quickly. The length of life of a wood block pavement is not directly proportional to the travel. Take, for instance, two streets laid with the same wood, in the same manner. If the traffic on one street approaches but does not reach the limit of durability of the wood. the pavement will last almost indefinitely because the character of the traffic is not sufficiently heavy to destroy it; but if this traffic in its character as well as amount passes the limit of durability of the wood employed, the pavement will be destroyed in a comparatively short time. It would seem that for each class of timber there is a condition of traffic beyond which it should not be subjected, but no determination of these limits could correctly be made except from a great number of actual service tests. In a general way, however, satisfactory results may be obtained by dividing the streets into three classes: heavy, medium and light travel. On the third class of streets practically any wood which would not decay would give an indefinite life. On the second class discrimination should be used, although woods as soft as Norway pine have given excellent results under these conditions. On the first class of streets it would probably. be dangerous to lay any wood less durable and resisting than the best quality of long leaf pine. So far the writer does not know of any available wood other than the black gum before mentioned which could be safely included with long leaf pine in this category. By this, of course, is meant woods which can be obtained in large quantities commercially, and which possess the element of toughness rather than that of extreme hardness.

While in Havana last July the writer saw a street—San Rafael street —beautifully laid with native hard woods, mostly mahogany, untreated.

The surface of this pavement was almost as smooth as glass and excessively slippery, so much so, indeed, that large areas of other streets in the city paved with the same material have been gone over by workmen with small chisels, who have cut the surface of the pavement into a sort of checker board of grooves so as to permit horses to safely travel over it. A somewhat similar, although not so extreme condition has existed on many streets in London laid with Australian hard woods, and the slipperiness of these woods has been the reason why they have so largely been laid with a wide joint between the blocks, this joint being filled with pitch and crushed stone or gravel so as to give horses a foothold. The result of laying pavements in this manner is soon to give a rounded or cobble stone effect, due to the edges of the block wearing off, thereby destroying one of the chief advantages of a wood block pavement. The practice of laying blocks with a tight joint is increasing in London as the use of the Australian hard woods is decreasing. It will thus be seen that the element of toughness and durability in a block is not the same thing as extreme hardness of the wood. Beyond a certain limit many woods are too hard to make a successful paving material.

Among the woods listed for the proposed test by the Department of Agriculture in New York, above referred to, it seems improbable that there will be found any woods possessing the advantages of either long leaf pine or black gum for paving material. The scrub oak, if it existed in large quantities, might make a very durable wood but for the fact that oak, owing to its great tendency to split when subjected to heat, is a very difficult wood to treat. Maple, the writer is inclined to believe, would prove slippery, and Virginia pine, loblolly pine, short leaf pine and the other inferior grades of pine would not make blocks suitable for the heaviest travel.

The writer recently tested a number of South American woods, some of them so hard and dense their absorption under the usual time of treatment was only four pounds of creosote oil to the cubic foot, running down to others which absorbed forty pounds. Some of these woods may prove useful for paving block purposes, but the great difficulty would be in separating the different kinds of wood. The tropical forests contain from twenty to twenty-five different kinds of woods, indiscriminately throughout the forest and not in large bodies of any one kind of wood. In getting them out these forests can only be successfully operated by taking out everything, thereby clearing the land for agriculture purposes, and with 15 or 20 kinds of wood which may be valuable for paving block purposes, the manufacturer would be obliged to separate these woods into several different classes having approximately the same toughness and durability, as otherwise the pavement would naturally wear very unevenly. The writer believes, however, that from this source some very excellent materials can be obtained for street paving purposes. A large enterprise is now under way to get out lumber of this character in the United States of Columbia, and some of it should be on the market in the course of another year.

The Douglas fir, or Oregon pine of the Northwest, is almost an ideal material for general paving block purposes. It is not quite so hard or tough as long leaf yellow pine or black gum, and for this reason will probably be excluded from streets of the most extreme travel; but with the exception of perhaps a very few streets of this character it would prove equally satisfactory, and possess the great advantage of being extremely regular and homogenous in texture so that the differences between hard and soft wood found in the smaller long leaf yellow pine trees would not exist and pavements could be laid which would wear with perfect regularity throughout their entire surface. There is no opportunity to secure this wood for paving purposes east of the Mississippi River at the present time, but with the completion of the Panama Canal it will no doubt become a very extensively used wood for all purposes in the eastern part of the United States.

Quite recently another wood has been suggested for paving purposes of which the writer has very little knowledge, either as to its physical properties or its availability. This wood is chestnut oak, which is found in Western North Carolina, Eastern Tennessee and Kentucky, and Northern Alabama. It resembles oak, but is softer and less rigid of grain. No experiments have been made with it, but it promises to make a good wood for paving block purposes if it can be obtained in large quantities at a reasonable price.

Recently the writer had a talk with Mr. B. T. Fendall, one of the members of this Association, and the city engineer of Baltimore, Md., who had just returned from a trip of several months through England and the continent, inspecting foreign methods of paving.

Mr. Fendall stated that he had nowhere in his travels seen as good wood pavements as those now laid in the City of Baltimore. This he attributes first, to the fact that the woods used, Norway and Swedish deal, Pyrenees pine and native French pines are softer than the long leaf yellow pine used in this country, and also to the fact that the blocks are not so thoroughly treated—only 10 pounds of oil to the cubic foot being used as against our 20 or 22 pounds.

Mr. Fendall also exploded some of the prevailing notions about the foreign pavements—notions which are very common and widespread in this country. One of these is the idea that the English or continental engineers use extremely heavy concrete foundations under their pavements. This is not true. The heaviest concrete that Mr. Fendall found anywhere abroad was 7½ inches in Germany, and the usual practice is six inches, generally gravel concrete. Most of these streets have been paved with macadam for many years and consequently when the sub-foundation is cut through the macadam sub-base looks like concrete and gives a wrong impression to the layman. Any engineer would know that foundations 12 or 14 inches thick, on ordinary well compacted sub-grades, would be only a waste of material.

Another point which impressed Mr. Fendall forcibly was the question of repairs. It has been stated time and time again that the foreign streets

are so well kept up that repairs are always made with extreme promptness. Mr. Fendall did not find this the case and cited several of the principal streets in Paris with many bad places in them and in need of repairs. He attributes these holes to the use of woods not homogenous in character and to imperfect treatment which allows some blocks to develop heart rot and quickly affect the surrounding pavement. This action of traffic on streets is one which affects largely the class of timber which can be utilized for street paving work. The writer has found from long experience that streets laid with blocks, some of which are hard and some soft, will wear very badly while the same street laid with all soft blocks would wear very well. This is due to the well known way in which one soft block will affect its neighbors, the wear extending from the one spot like a disease. The most perfect example of this that the writer has seen was in Havana this summer. The United States Wood Preserving Company. some five or six years ago, furnished to the highway department of the City of Havana, several hundred yards of yellow pine block for a test on one of the heaviest traveled streets in that city. These blocks were of the old size 4-inch by 4-inch by 8-inch and in laying them careless workmen sometimes put them down with the grain horizontal instead of vertical. The street in question has a very heavy travel of two-wheeled carts carrying heavy loads. Six blocks were laid in this street the wrong way. At the end of some five years there were six shallow depressions in this street some 24 inches in diameter and perhaps 2½ to 3 inches deep, perfectly regular and having at the bottom of each, in the exact center, a block laid the wrong way. With the exception of these six holes the street is in perfect condition. This shows clearly the way in which a soft block or a block wearing more rapidly than the surrounding blocks will infect, as one might say, its neighbors.

There is a general, although erroneous, idea widespread in this country, that abroad the bulk of the paving is done with Australian hard woods. This is by no means true. The use of these woods is decreasing abroad. The English engineers have almost given up the use of the Karri wood, although Jarrah is still employed to a considerable extent. It is laid untreated, with an open joint to prevent slipping, as above stated.

On the continent, especially in Germany, tallow wood is liked better than either of the others, but none of the three are in great favor. Mr. Fendall learned in Germany that the German engineers use large quantities of wood laid with close joints, on grades, because this pavement is less slippery than asphalt. It is fair to say that the asphalt employed is rock asphalt.

So far as our experience has gone is seems true that the best woods for paving block purposes are those which are dense and homogeneous, with little, if any, difference between the durability of different parts of the block, tough rather than hard, and capable of treatment without danger of warping or splitting.

In addition, from a commercial standpoint, it should be necessary that such woods are obtainable in large quantities at reasonable prices. At this

time it is safe to name four, in the order named: Long leaf yellow pine, black gum, Oregon pine, Norway pine. Beyond these it is not certain what the results may be, although short leaf pine and tamarack have both been used in limited quantities, and the writer sees no reason why they should not be successfully employed if used on suitable streets.

The question is one upon which continued experimentation will throw more and more light as more tests are made and more results tabulated. To draw general conclusions from insufficient evidence is as useless in this as in any other subject.

THE PRESIDENT: All these papers on the subject of paving are now open for discussion. If the Association would like to hear the paper read on "Earth Settlement in City Streets," by Horace Andrews, Consulting Engineer of Albany, N. Y., it will be read.

EARTH SETTLEMENT IN CITY STREETS.

BY HORACE ANDREWS, CONSULTING ENGINEER, ALBANY, N. Y.

This paper is in large part, a compilation of material that exists in a very scattered condition. The writer has endeavored to make his practical recommendations a summary of the best usage and has drawn upon his own experience in many years of observation with clayey soil and a severe winter climate.

COMPOSITION OF SOIL.—The composition and physical characteristics of the soil upon which buildings and street pavements rest influence the permanence of these constructions.

Geologists define a rock as "any bed, layer, or mass of the material of the earth's crust," but as this word in common language is understood to apply solely to the consolidated material, it is better and more usual to employ the words soil or earth to distinguish the loose material derived from the disintegration of the harder rocks.

From the agriculturist's point of view the physical properties of soils have been investigated with great care, less attention, however, seems to have been paid to the causes of their shrinkage and expansion which are of more importance to the engineer.

The soil consists of "(1) mineral grains of various sizes, grouped in different ways and either insoluble in water or soluble with difficulty, (2) the water which covers the soil grains and contains in solution a varying amount of the soluble soil constituents and (3) the soil atmosphere, differing only slightly from air in composition and saturated, usually, with water vapor."

TEXTURE AND STRUCTURE.—The texture of the soil refers to the different size of the soil grains while the arrangement of the grains in respect to one another has been termed its structure. By a change in structure of any particular soil, the change in the mean size of the interstitial

spaces is understood; when a soil shrinks these spaces must diminish in size while their enlargement will also increase the entire volume of the soil.

A gravel soil of very coarse texture may have the same percentage of voids as very fine sand. By mixing soils of different texture together the percentage of voids may be diminished, whether the separate grains are large or small, provided that the smaller grains will just about fill the voids between the larger. "In a heavy clay soil, one-half of the dry weight may be made up of soil grains as small as 1-25,000 of an inch in diameter" (King).

WATER IN SOILS.—If the spaces between the grains of a soil are entirely filled with water, the grains are generally capable of being moved more easily by packing or ramming the soil. When thus consolidated the soil is said to be puddled. "When a fine grained soil is thoroughly puddled, all of the small clusters of grains are completely broken down, and the smallest particles are packed in between the larger ones until its cavities are so completely obliterated that even water will not penetrate it" (King). However compactly puddled a soil may be, its water contents will be large, and when the water is lost by evaporation the soil grains seem capable of approaching each other, as is noticeable in the shrinkage of clay. Hence it may be concluded that the water in the interstices actually holds the grains apart.

Puddled material may hold its grains so completely filled with water that little free air is present, except that absorbed in the water itself. This "water-logged" soil is of great importance in the construction of embankments to retain water, as in reservoirs, in which position it readily maintains its puddled character.

Prof. F. H. King, in his work on "Irrigation and Drainage," gives information as to the capacity of soils to store water. "A fine sand which held in the first foot above the ground-water 23.86 per cent. of its dry weight of water, at 8 feet above was found to hold only 3.14 per cent. of the dry weight"; a cubic foot of the dry sand weighing 105 pounds. The loss he attributes chiefly to downward drainage or percolation and also to upward capillary movement and surface evaporation. Many soils when they become very dry, develop shrinkage cracks, but repeated small applications of water will again saturate the soil to some degree and it will then expand and close up the shrinkage cracks. Prof. King comments upon the drying of clay soil as follows: "The firm hard character of a clay soil when it loses its moisture is due to the fact that the grains are so small and so close together that the little material which is held in solution in the soil-water cements them together when dry. Were the grains large like those of the sands, with few of the fine particles between them, the contract areas would be so few and so small that little binding could result."

This theory of Prof. King is not entirely corroborated by the experiments in the Road Material Laboratory, Department of Agriculture, for

Mr. A. S. Cushman, commenting on the cementing value of the powders of various rocks, says: "Rocks which, on chemical analysis, show themselves essentially identical in composition frequently vary widely in cementing value." He considers the classification of materials according to the size of the particles into silts and clays to be incorrect and shows that powdered glass in the finest state of subdivision has no cementing value whatever. The difference in cohesion that exists between various materials in the same state of subdivision does not yet seem to have been adequately explained. Mr. Cushman's experiments show that high cementing values have a decided tendency to accompany a high water content but exceptions occur. As regards shrinkage, it would seem to the writer as if capillary attraction, in clays, where the texture is very fine, may serve to keep the grains apart until the water content is removed by evaporation, when they come more closely into contact. In a letter to the writer, Mr. Cushman remarks: "In general I think it safe to say that a clay that holds a high percentage of water, when *air dried* will usually have a high shrinkage and vice versa. I am inclined to the belief that the shrinkage is a function, and therefore to some extent a measure of the colloidal constituents of the clay or soil."

In cities, a lowering of the ground water is usually effected by the construction of sewers. Baldwin Latham remarks in this connection: "The mere fact of carrying out a system of sewerage, and being obliged to cut through various strata of a more or less retentive character is naturally a means of securing to a great extent subsoil drainage," and he goes on to show the importance of securing subsoil drainage by special means. Folwell states that with the best of cement joints with pipe sewers laid in wet ground, the leakage may amount to from 5,000 to 20,000 gallons per day per mile of sewers, and he adds: "In very many systems it is more than ten times this amount."

Prof. King points out that "when the deeper clays dry out, as they will after underdrainage, shrinkage checks form in them in great numbers opening tiny fissures through which the air moves more freely with every change of temperature and pressure of the atmosphere above." This tendency of the soil to breathe with change of temperature and barometric pressure is of great hygienic interest, in the presence of foul sewers and leaking gas mains, but as concerns the subject of this paper it is of interest as denoting an increased probability of the evaporation of moisture and a corresponding shrinkage.

By simple percolation, without the breathing of air into the soil, a rapid initial drainage occurs, after which the loss of water is extremely slow, especially in soils of fine texture. Prof. King shows this in a table in his work above cited, where it appears that in a column of very fine sand completely saturated, and eight feet in depth, over 10 per cent. was still retained at a point four feet below the surface at the expiration of two years. The original water contained in this sand when saturated was 24 per cent.

EFFECT OF FROST.—The effect of freezing in expanding soils will serve as an index to the water content and will further indicate that a loss of this water by evaporation or drainage will prevent lifting by frost. Where man-holes are built in sidewalks the effect of frost is frequently visible in a raising of flag stones above the man-hole rim. This lifting has been observed by the writer to amount to as much as two inches. The specific gravity of ice is about 0.92; one cubic foot of water will become 1.087 cubic feet of ice. Soil containing 20 per cent. of water in its interstices might therefore reasonably be expected to rise about 0.1 feet when it freezes to the depth of 3½ feet. The necessity of maintaining a dry foundation in such cases is obvious.

It is shown, in the levels taken on the asphalted surface of Center market in Albany, hereinafter referred to, that frost at its first occurrence may raise the surface and that this raising will be permanent. Many brick pavements are cracked in a manner difficult of explanation except by the raising action of frost. Pavements laid on dry soil and specially where a period of many weeks allows of some lessening of the water contents, by percolation, before severe frosts occur, seem less apt to suffer from the lifting effects of frost.

COMPRESSION UNDER LOADING.—In founding buildings on natural soil it is customary to ascertain the compression under a measured load resting upon a given area, usually one square foot, and when the bearing power of the soil has been thus ascertained a conclusion is reached as to the permissible load per unit of area. In most municipal works, and more especially with street pavements, the load per unit of area is very small and the natural soil is amply able to bear its load, when suitably protected by the hard surface of the pavement.

Very dry materials are readily compacted by ramming or rolling. Trautwine gives the weight of Rosendale cement per cubic foot as 60 pounds loose, 70 pounds well shaken and 80 pounds thoroughly shaken.

Mr. A. Black has recently given the percentages of voids in three specimens of sands as 35.0 per cent., 32.3 per cent., and 38.4 per cent. when loose; after being shaken down these were respectively 26.7 per cent., 27.3 per cent., and 31.4 per cent.

A sand cushion 1¾ inches deep is compressed to 1½ inches after rolling, when used as a cushion for a brick pavement.

Rolling the foundation of a pavement, in some soils, will bring more moisture to the surface, by capillary attraction, from depths as great as four feet. The writer has seen a 10-ton steam roller sink so deeply into a clay sub-foundation that it could be moved again only after prolonged work in digging it out. The rolling in this case had the effect of softening the foundation. Usually a compression by rolling, with a weight per inch of run of roller as great as the maximum wheel load the pavement will be called upon to bear, is desirable, but in the case of wet clays a very light rolling or tamping is all that can be done in the way of consolidation.

SUPPORTING POWER OF SOILS.—Prof. Rankine has developed the theory

regarding the supporting power of soils, his mathematical deductions have to do with the mutual friction between the grains composing the soil.

"In a mass of earth the active forces," he states, "are the vertical pressures produced by the gravitation of its parts; the passive forces are the pressures conjugate to those vertical pressures whereby the earth is prevented from spreading.

"Earthwork gives way by the slipping or sliding of its parts on each other; and its stability arises from the resistance to the tendency so to slip. In a mass of earth as commonly understood, it arises partly from the friction between the grains, and partly from their mutual adhesion, which latter force is considerable in some kinds of earth, such as clay, particularly when moist. But the adhesion of earth is gradually destroyed by the action of air and moisture, and of the changes of the weather, and especially by alternate frosts and thaw; so that its friction is the only force which can be relied upon to produce permanent stability." "The permanent stability of earth, which is due to friction alone, is sufficient to maintain the side either of an embankment or of a cutting at a uniform slope, whose inclination to the horizon is the 'angle of repose,' or angle whose tangent is the coefficient of friction. This is called the natural slope of the earth."

Sometimes embankments for city streets have to be formed on soft and yielding soils, such, for example, as the salt marsh at Hoboken, N. J., described by Mr. Thomas H. McCann (Trans. Am. Soc. C. E., March 17, 1897). The depth of this marsh was from 30 to 100 feet. "There is little displacement of the meadow at the sides of the fill where the latter is not more than 10 or 12 feet deep, but where it reaches greater depths the meadow is forced up." "First, there is a compression and displacement of the lighter and softer marsh by the heavier filling; second, a shrinkage of the filling material and about the time the road is finished the embankment is floating, so to speak, on the marsh; third, the embankment settles gradually, compressing or displacing (in many cases doing both) the softer marsh. This settlement continues for many years, and, of course, is greatest in a road on which there is a heavy traffic."

According to Rankine's theory, all embankments may be said to "float upon the natural soil." It is interesting to notice the amount of compression and displacement of the marsh under the embankment, which Mr. McCann has determined by borings and which substantiate Prof. Rankine's theory. The relative weights of natural ground and embankment in the case cited are not known to the writer, but assumed values will be of interest. For example, if the weight per cubic foot of the marsh is assumed as 99 pounds, and that of the embankment as 110 pounds, while the angle of repose of the marsh material is assumed as 15 degrees; Prof. Rankine's formula would indicate that the depth to which the embankment would sink into the marsh would be five-eights of its proposed height above it. This sinking, he suggests, may be counteracted by first digging a trench and filling it with stable material.

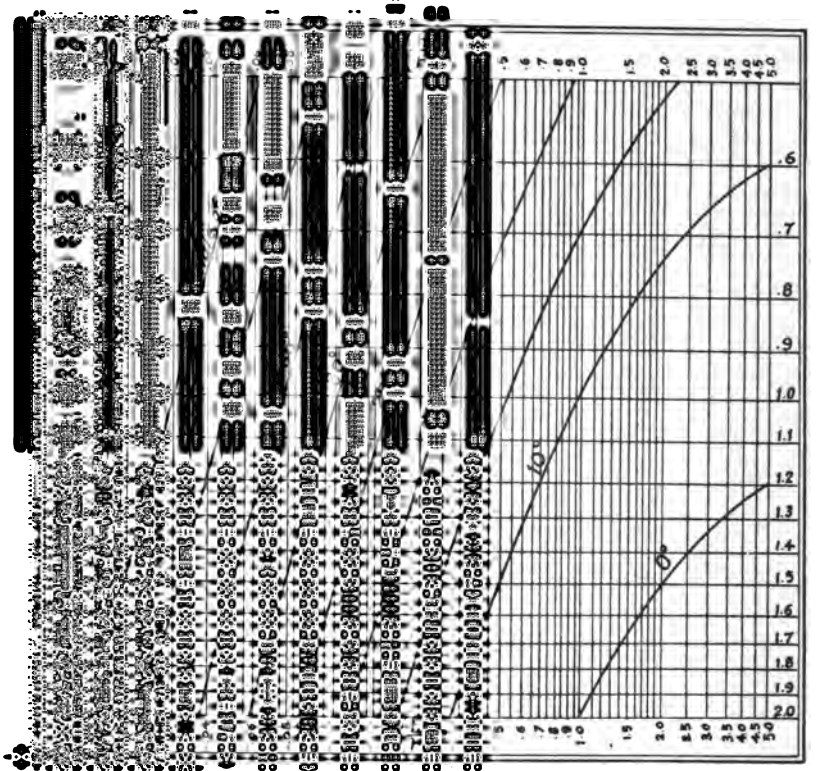
Where a city street is to be formed by embankment, made upon ground of almost any nature, and prolonged settlement is undesirable, it would be expedient to dig out a trench for the foundation, in the first place; or at least the material beneath the center of the embankment

	Angle of Repose of Natural Ground.								
$\frac{w'}{w}$	0°	10°	15°	20°	25°	30°	35°	40°	45°
0.5			2.25	0.92	0.49	0.29	0.17	0.10	0.06
.6		4.76	1.36	.67	.38	.23	.14	.09	.05
.7		2.43	0.98	.52	.31	.20	.12	.07	.04
.8		1.63	.76	.43	.26	.16	.10	.06	.04
.9		1.23	.62	.36	.22	.14	.09	.06	.03
1.0		0.98	.53	.32	.20	.12	.08	.05	.03
1.1	10.	.82	.46	.28	.18	.11	.07	.04	.03
1.2	5.	.70	.40	.25	.16	.10	.07	04	.02
1.3	3.33	.62	.36	.23	.14	.09	.06	.04	.02
1.4	2.50	.55	.33	.21	.13	.09	.06	.04	.02
1.5	2.	.49	.30	.19	.12	.08	.05	.03	.02
1.6	1.67	.45	.28	.18	.12	.08	.05	.03	.02
1.7	1.43	.41	.26	.16	.11	.07	04	.03	.02
1.8	1.25	.38	.24	.15	.10	.07	.04	.03	.02
1.9	1.11	.35	.22	.14	.10	.06	.04	.02	.02
2.0	1.	.33	.21	.14	.09	.06	.04	.02	.02

w' = weight per cubic foot of natural ground

w = " " " " " " " embankment.

The table gives values of co-efficient by which height of embankment must be multiplied to find depth of cutting below natural surface, to ensure stability of bank



Rankine's Civil Engineering. p.343

$k' = \frac{1-\sin\phi'}{1+\sin\phi}$.

Repose of natural ground

cubic ft

car'n. into

cubic foot of the embankment

ortion of the side slopes, with-
s computed the accompanying
on, from Prof. Rankine's some-
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ble, which is given both numi
o later in another connection.
settlement of an embankment
ne to be seldom less than one-
the original height. Prof. M.

Sapper, of Hanover, suggests that the settling of embankments should be neutralized by increasing both their heights and widths as follows:

Nature of Embankment.	Extra Height.	Upper Widening.
Loamy, clay ground.....	1/12 h.	1/8 h.
Mould, black earth.....	1/14 h.	1/9 h.
Sandy soil	1/23 h.	1/15 h.
Gravel dump	1/30 h.	1/25 h.
Stone dump	1/40 h.	1/40 h.

"h" represents the height of the embankment on level ground, in inclined ground the value of "h" is equal to the height of the top of the bank above the lowest edge of the down-hill slope.

Both the English and the American practice is to assume that soil removed from cuttings will not measure as much in a settled bank as it did in the original cutting. Mr. P. J. Flynn has discussed this matter in an interesting paper before the Technical Society of the Pacific Coast, June 5, 1885 (given in Eng. News, May 8, 1886). He comments as follows:

"The disagreement of the German authors from the American and English practice as to shrinkage is certainly remarkable. The Germans give on the whole, a permanent *increase* for sands, clays, and similar materials; but on the contrary the Americans and English give a *diminution.*" Prof. Baker, in his admirable treatise on "Roads and Pavements," summarizes the reasons for the shrinkage of earth embankments as follows:

"(1.) The continued action of frost has made the soil in its natural position more or less porous.

(2.) Earths which have been lying in situ for centuries become more or less porous through the slow solution of their soluble constituents by percolating water.

(3.) The surface soil is rendered more or less porous by the penetration of vegetable roots which subsequently decay.

(4.) There is ordinarily more or less soil lost or wasted in transporting it from the excavation to the embankment."

It appears to the writer that a fifth and very important cause of shrinkage arises from the change in water content of the soil. In an embankment, drainage and evaporation can reasonably be assumed to deprive the soil of much of the moisture it contained while in its original bed. The deprivation of moisture will cause more shrinkage in clay than any practicable consolidation by mechanical means. The writer made the following experiment regarding this shrinkage. A section of undisturbed clay was removed from a depth of four feet below the surface of a sidewalk, in the City of Albany. and was carefully trimmed to dimensions, without disturbance of the natural layers. The clay was good brick-clay and contained apparently less moisture than at lower depths. It was found to weigh 119 pounds per cubic foot. It was exposed to natural summer atmosphere in August, in a shaded place, the humidity of the

air being from 40 per cent. to 70 per cent. Pins were placed in the clay and measurements made between them from time to time, at the end of two days the clay had divided into two parts along a plane of stratification about in its center, but no other cracks of any magnitude appeared during the progress of the experiment. Its loss of weight was then 12 per cent. of the original weight and the distance between the pins had contracted by 6.3 per cent.

After six days' drying, the clay, which at that time appeared quite dry and hard, was again carefully measured and weighed. It had then shrunk to 86.9 per cent. of its original volume, and weighed 105 pounds per cubic foot, the distance between the pins had shortened by 7¾ per cent., and the weight had diminished by 23 per cent. of its original amount. The water in the pores of the clay still continued to evaporate, however, and at the end of two weeks the entire loss was 28 per cent. of the original weight. This compact clay therefore contained about 38.8 per cent. of its dry weight of water. Although it was when first dug out, packed much more firmly than any ordinary consolidation by mechanical means could have effected, nevertheless it was capable of a shrinkage in volume of over 13 per cent. by evaporation alone.

This experiment indicates that in clay soils, and possibly in others, the loss of water by drainage and evaporation may account for much shrinkage and settlement. It has been observed that a brick from a stiff-mud machine will shrink from 5.7 to 10 per cent. in its linear dimensions on leaving the drier. (Tr. Am. Soc. C. E., Vol. 29, p. 664.)

Mr. Eliot C. Clarke instances a case in connection with the main drainage works of Boston where a deep trench "drained the water out of the adjacent soil, rendering it spongy and somewhat compressible, so that the whole street settled and had to be resurfaced and repaved."

Referring again to the table computed from Prof. Rankine's formulas, it is seen that just as a ship sinks a certain distance into the water before it is held in equilibrium (the angle of repose of the water being zero) so an embankment may be found to sink into the natural soil and thus appear to shrink and occupy less volume than when its material was removed from its original position. Even with an angle of repose of 30 degrees and with natural soil of the same density as that of the embankment, the table indicates that ultimate stability will only be attained when a settlement—or apparent shrinkage—of 12 per cent. has occurred. This settlement may be extremely slow and the embankment may for years be in an unstable condition, for the angle of repose is a somewhat uncertain and variable quantity and will be affected also by changes of water content in the interstices of the soil. It is not maintained by the writer that a subsidence as great as the tabular amounts may be expected under every embankment, the compression of the soil by the weight of the embankment may soon increase its density and thus retard further settlement, still it is reasonable to suppose that part of the assumed shrinkage of earthwork may be due to an actual subsidence into

the underlying natural soil. The whole matter of the shrinkage of earthwork does not seem to have been investigated very scientifically. To this end the amount of water contained in the soil before removal from the cutting and the weight of the soil per cubic foot both in its natural condition and after drying completely, without disturbance, should be ascertained and the same data should be secured from the embankment at various depths and at different lengths of time, while careful notes should be made as to the physical character of the soil, the amount of rainfall and the method of depositing the earth in the embankment. Borings or test pits should also be made to show the amount of subsidence of the embankment into the natural soil.

It does not seem that the method of tipping the earth or of consolidating the earthwork would materially affect the ultimate amount of shrinkage, although a much greater time might have to elapse with imperfect initial packing of the earth than if greater care had been taken with this. Hewson, in his work on levees, says: "Sand, however loosely it may be shovelled together fills its space closely; and therefore whether wet or dry, settles at a very small diminution of the original bulk. In time, too, the process of the settlement is short."

Regarding clay embankments, on the other hand, Spons Dictionary of Engineering states that settlement may in some cases continue for ten years. In those portions of the City of Albany where the subsoil is a dense, wet clay, precautions sometimes are taken to maintain the moisture at its normal amount. Under certain buildings this has been secured by irrigating the foundation. Trees are occasionally cut down when their roots are thought to have too great an effect upon the drying of the soil. This drying effect is much greater than is often supposed and city trees should be provided with means of obtaining a sufficiency of water. Prof. King shows that a growing crop of corn will use from 200 to 300 pounds of water per pound of dry material produced.

Where streets are covered with a water-tight pavement, the entire street surface in some cases seems to settle slowly for many years in a manner that it is difficult to account for except by a slow drying out of the water contents of the clayey subsoil. In this case a renewal of the pavement with a re-surfacing of the original concrete base should effect a permanent improvement.

Under a water-tight pavement there is probably at first a certain loss of water by downward percolation, until a condition of equilibrium is reached when capillary attraction thereafter maintains a nearly fixed amount of water drawn from the underlying ground-water. The writer has investigated the actual changes in level of Center Market in Albany.

The site of this market comprising 7,461 square yards of asphalt pavement, was covered with buildings and by the adjacent sidewalks. The buildings were removed in 1888 and the site was graded in December of that year, there being no filling except in the cellars of the houses. A sheet asphalt pavement on a six-inch concrete base was laid in the sum-

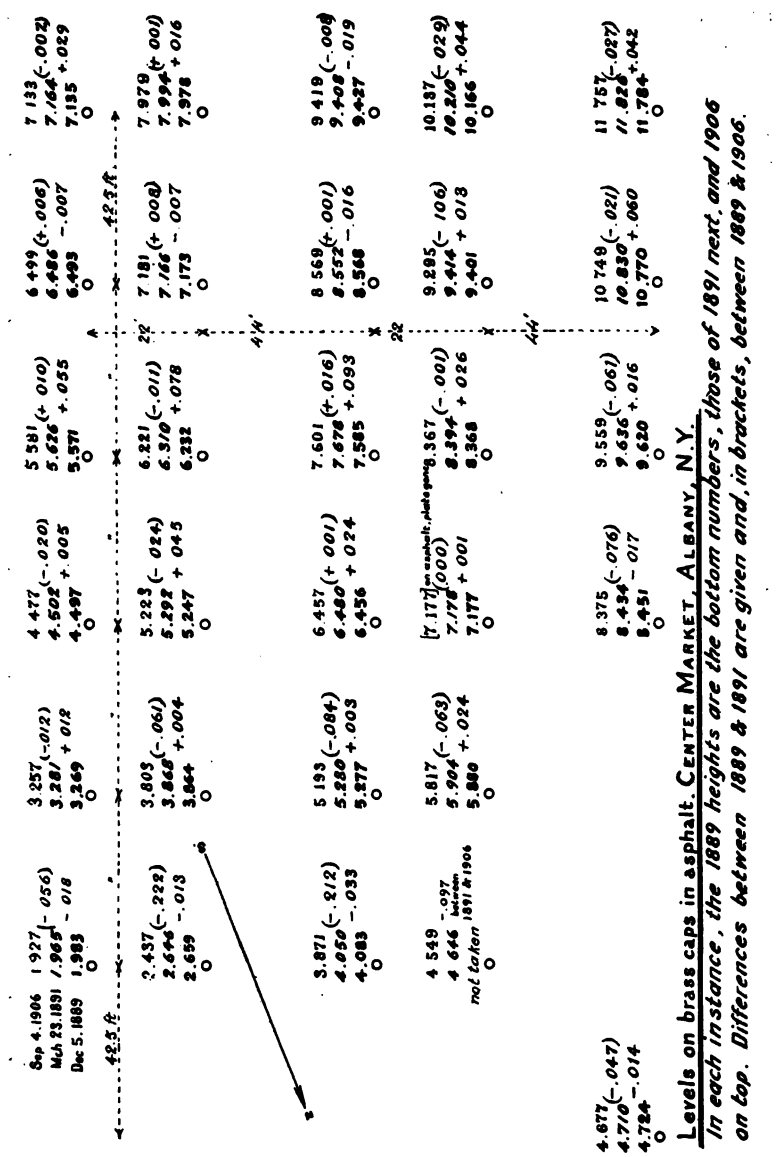
mer of 1889. Numerous brass caps were placed in the asphalt, with their bases resting on the concrete, at intervals of about 44 feet. The levels of these were determined in December, 1889, over about 3,000 square yards of the area. The levels were repeated in March, 1891, 15 months after the first and while there was frost in the ground. Nineteen of the brass caps were found to have risen 0.031 feet on an average, while 9 had sunk 0.016 feet on an average. The greatest rise was 0.078 feet and the greatest settlement was 0.033 feet. The levels were repeated September, 1906, 16 years 9 months after the first levels, the asphalt having remained undisturbed meanwhile, but in daily use. Twenty-one of the caps were then found to have sunk from 0.002 feet to 0.222 feet, the average settlement of 0.059 feet being partly attributable to slight wear of the brass caps.

The remaining seven caps were from 0.001 feet to 0.016 feet higher than originally observed and it would appear with these as if the heaving observed in March, 1891, had never been entirely overcome by subsequent settlement. These levels are diagrammatically shown on next page.

CONSOLIDATION.—Consolidation of undisturbed soil is best effected by rolling with as heavy a roller as the nature of the soil will permit. Where, as has already been pointed out in the case of clay subsoil, a light roller must be used, it should be passed over the surface a greater number of times than would otherwise be necessary and the roller should be used transversely, as far as this may be practicable, as well as longitudinally. Where a roller can not be used, for lack of room, tamping by hand must be resorted to. This is very laborious work and is frequently slighted. Large embankments are sometimes consolidated by rollers, but generally their use in this connection is restricted to embankments for retaining water. Where a city street is to be formed in embankment and it is desirable that the ultimate settlement should be secured without long waiting the use of rollers, especially the so-called grooved rollers may be quite desirable. The most vexatious irregularities in city streets are caused by the cutting of trenches without sufficient effort to obtain, or indeed where it may be nearly impossible to secure the ultimate settlement before the pavement is laid. Where the ground is quite pervious to moisture and it is well under drained, a very liberal use of water will cause grains of sand and gravel of different size to pack closely and the surplus water will drain off, thus effecting a very compact and unshrinking filling.

With retentive and wet soil and clay back-filling the use of water will most certainly be followed by slow settlement which may continue for many years with disastrous effect upon street pavements or sidewalks.

Where a cut must be made in an existing pavement and the soil on the sides of the trench is retentive to moisture, dry granular material should be used for the back-filling. This filling need not be of an expensive nature, steam-ashes, or rubbish such as broken bricks and mor-



tar from the removal of old buildings—called "hard-core" in England—will answer the purpose well. Very careful and thorough pounding is essential, if clay and loam are used for back-filling, and even then it

will be found quite impossible to pack lumps of clay without leaving large voids, even if the rammer has a small cross section. This latter requirement is essential if clods of clay are to be broken; a light rammer also will be more efficient in securing good work than a heavy one which will soon exhaust the laborer. The writer believes that back-filling of trenches where no subsequent settlement is to take place can only be secured, in many soils, by the use of other power than human muscles for the tamping. A given expenditure of money should secure better results through tamping with compressed air, steam, or other similar source of power than where human muscular effort is relied on.

Earth filling is said to have been very perfectly consolidated by the feet of goats in the formation of puddled walls for reservoirs, but in city streets such means of tamping loose material would seem to be impracticable.

In contract work involving the back filling of trenches, the writer secured great improvement in the pounding of the filling by making the number of days labor for this end one of the items in the approximate quantities and by inserting the following clauses in the specifications:

"BACK-FILLING OF TRENCHES.—All back-filling is to be well and thoroughly pounded in thin layers. The number of men back-filling is never to exceed that of the men pounding. The contractor is to be responsible for all settlement over the lines of trench, and to take up and relay the concrete and pavement if such settlement causes perceptible hollows in the pavement during the five years period of guarantee. Water tamping is not at any time to be used except in porous and gravelly soil. Wet clay is not in any case to be used for back-filling. Frozen material is in no case to be used for back-filling.

PRICE PAID FOR LABOR.—For labor actually performed upon the work of pounding the material filled into trenches, the contractor will be paid in accordance with his price bid for each day's labor. The amount of such labor is to be verified by the inspector and is to be expressed in days and hours."

The object sought was to secure from the contractor work on the pounding with no pecuniary loss to him. From motives of expediency it was found that the contractor invariably made his bid at the prevailing rate of wages.

MISCELLANEOUS TRENCHES.—In case a pavement is under guarantee of maintenance for a term of years it has been the practice of the writer to provide that the contractor shall do all the back-filling of trenches where cuts are made in his pavement during the period of guarantee, in accordance with the following specification:

"PRICE TO BE PAID FOR REPAIRS TO CUTTINGS.—All back-filling to be of selected dry material, acceptable to the city engineer, and thoroughly tamped in place in thin layers, to be furnished and tamped at the rate of 75 cents per cubic yard for the first ten cubic yards, and at the rate of 60 cents per cubic yard for each yard over the first ten cubic yards. The

above prices to include the removal of the old material excavated. In case the old material excavated is, in the opinion of the city engineer, suitable for back-filling, it must be so used and one-third the prices named above for new material will be paid for the tamping and consolidation of such old material."

Other clauses provide for the repaving over cuts, and for the terms of payment for this, also that the contractor's guarantee of maintenance shall apply to all such repairs as well as to his original work.

In the miscellaneous cuttings in paved streets, it would seem proper, and indeed quite essential, if prolonged settlement is to be avoided, that the work of back-filling should be done entirely by the laborers of the city, under competent supervision. The regulations of the City of Washington seem admirably designed to secure good work in this respect. The back-filling and repairing are done by the city at fixed prices, which are charged against those to whom permits are issued. Deposits from all plumbers are required and when the charges against any plumber are found to be exhausting or depleting his deposit he is required to make good the deficiency or to have all future permits for cuts withheld.

Most of the evidence available indicates that it is very difficult but not impossible, to replace all of the old material excavated, where the tamping depends upon the muscular efforts of laborers. With small excavations as, for example, post holes, the laborer retains sufficient energy to replace all the material excavated notwithstanding the comparatively large volume occupied by the post.

With trenches for laying pipes, the space actually required for a sewer or water pipe should be taken into consideration. The writer has devised the following convenient rule for ascertaining the displacement due to sewer pipe: "The number of cubic yards displaced by 100 feet of pipe is equal to 0.03 of the square of the pipe's inside diameter in inches." The rule assumes the pipe to be laid in two foot lengths and under that supposition makes allowance for the hubs. For example, a 10-inch pipe is found to displace 3 cubic yards per 100 feet by the above rule, more exactly this should be 2.94 cubic yards, while a 30-inch pipe displaces 27 cubic yards, the rule being quite precise for this and other large sizes of pipe.

Mr. E. W. Hammatt gives for displacement of water pipe (Eng. News, April 7, 1898):

6 inch	0.27 cub. ft. per ft.	1.00 cub. yds. per 100 ft.
8	0.44	1.63
10	0.69	2.56
12	0.96	3.55
14	1.29	4.78
16	1.66	6.15

The article referred to contains many useful practical remarks as to the back-filling of trenches.

PROVISION FOR PROTRACTED SETTLEMENT.—Even with faithful work it seems nearly impossible to avoid some settlement in clayey back-filling, and as the subsidence will continue for several years, it may be expedient in some cases, as for example with deep filling within retaining walls at bridge approaches, to provide temporary pavements and sidewalks, with the intention of replacing these with more permanent ones in the future.

As stated in a "Special Consular Report on Streets and Highways in Foreign Countries" in 1891, the City of Frankfort-on-the-Main, having a soil which "forms an uncertain and treacherous foundation for pavements, especially when the original earth has been previously disturbed by the laying of sewers or water mains," makes a practice of laying temporary stone block pavements and "after some years of use have thoroughly settled and solidified the ground to take up the temporary pavement" and relay a permanent pavement in its place.

Although this procedure seems an open acknowledgment of defeat in the conflict, still it may be the part of wisdom and expediency to allow the forces of nature to do their worst in the matter of earth settlement and afterwards to found pavements and sidewalks upon the thoroughly established surface.

Time, indeed, is the potent factor in securing stability, but a careful study of the peculiarities of the soil, with vigilant inspection and a very liberal expenditure of energy in consolidating the filling, may in a great measure supplant the necessity of long waiting for ultimate settlement.

THE PRESIDENT: We want to get the report of the Committee on Exhibits in, and it seems to be necessary to get it in just at this time. I will ask Mr. Davis to present it.

REPORT OF THE COMMITTEE ON EXHIBITS.

The Committee on Exhibits desires to report as follows: That owing to certain delays the actual work of the exhibit portion of the convention was not started until about August 10. Your committee found it impossible to secure the desired number of exhibitors in so short a time, as the freight rate, distance for shipping exhibits were also against them in their work. But your committee feels that all municipal supply people exhibiting this year are well pleased, and recommend that the Exhibit Committee be continued as one of the committees of the Society, feeling assured that at the next convention held in the City of Detroit, the exhibit portion of the convention will be one that will attract great interest to all concerned.

The committee wishes to further report that they have secured a number of new associate members whose names and dues have been reported to the Secretary.

ROBT. K. DAVIS, *Chairman.*

MR. DAVIS: I would further like to make the report to the convention on behalf of our committee. Great praise is due in this work to Mr. Julian Kendrick, of Birmingham, and as chairman of that committee I want to take this opportunity to thank every one of the corporate members who were on the Exhibit Committee with me, for the efforts and the support they gave me in that work, as an associate member of the Society. I have other work to do in regard to closing the exhibits, and I have to get away, and that is the reason I wish to make the report at this time.

THE PRESIDENT: You have heard the report. If there is no objection it will be accepted and filed.

MR. FOLWELL: The amount of work could hardly be measured by the exhibits themselves, for I happen to know that Mr. Davis and Mr. Kendrick have done a great deal of work in getting up the exhibits. I move that the thanks of the Society be extended these gentlemen for their efforts.

THE SECRETARY: In seconding that motion, I want to reiterate what Mr. Folwell has said, and add to it by making it still stronger by saying that if it had not been for Mr. Davis there would have been no exhibit this year. Owing to unforseen circumstances it was necessary for the original chairman to resign, and as the members of this Society very seldom see each other, except at these meetings, it was extremely difficult to start anything at all, and what was done was done very late, and I know that had it not been for Mr. Davis' efforts, and had they not been unusual of themselves, we would have had no exhibits.

MR. KENDRICK: I want to say that Mr. Davis should not have thanked me for what I did, for as a matter of fact I would not have done anything if he had not made me do it.

THE PRESIDENT: As President of the Society, I want to add my word to the exhibits. My connection with the committee has been largely in preparing and submitting the program for publication and I want to say that Mr. Davis has shown the greatest energy in getting the matter through, and I want to say that I

was very much surprised that he was able to do it in the short time at his command. I am sure he will have something at Detroit next year well worth having. The report is accepted and placed on file.

MR. FOLWELL: Should there not be a motion that this committee be continued another year?

THE PRESIDENT: The adoption of the report carries that. The papers are now ready for discussion if you are not too hungry. It is a quarter past one.

MR. REIMER: Mr. Chairman, sometimes we lose members by the fact that they don't renew their dues, some will go away, and others come, but seldom in this Association has one been lost through death. I would like to offer this resolution:

WHEREAS, It has pleased an All Wise Providence to remove from us one who was once our President and an enthusiastic member of this Society, who was an energetic and faithful municipal officer and a man honored by his home city by continuing him in its service for many years; therefore, be it

Resolved, That this Society express its sorrow at the loss by death of Mr. George M. Ballard, late of the City of Newark, N. J., and that our sympathy be conveyed to the family of the deceased by sending to the same a copy of this resolution, and that this preamble and resolution be spread upon the minutes of this Society.

THE PRESIDENT: You have heard the resolution; if there are no remarks, those in favor of the resolution will please rise.

(Resolution was adopted by unanimous vote.)

THE PRESIDENT: We have an election of members to take place at this time, and I will ask the Secretary to read the list.

CORPORATE MEMBERS.

Prof. Edward B. Kay, Tuscaloosa, Ala.
E. L. Dalton, City Engineer, Dallas, Tex.
Geo. P. Codd, Mayor Detroit, Mich.
P. W. Henry, Consulting Engineer, 17 Battery Place, N. Y.
F. E. Murphy, Supt. Streets and Water Works, Huntsville, Ala.
J. L. Ludlow, Consulting Engineer, Winston-Salem, N. C.
Wright Smith, Chief Engineer Board of Public Works, Mobile, Ala.

W. M. Wilson, City Engineer, Gadsden, Ala.
Francis H. Wright, City Engineer, Helena, Ark.
C. E. Leonard, City Engineer, Austin, Tex.
Nisbet Wingfield, City Engineer and Com. Pub. Works, Augusta, Ga.
Wm. Solotaroff, Supt. Shade Tree Com., East Orange, N. J.
Geo. S. Watson, Consulting Engineer, 54 Baxter Bldg., Philadelphia, Pa.
R. H. McCormick, City Engineer, Detroit, Mich.
Allen R. Gilchrist, City Engineer, Montgomery, Ala.
J. K. Mitchell, General Assistant Engineer, Detroit, Mich.
Wm. J. Parkes, City Engineer, Pine Bluff, Ark.
Wm. F. Day, Engineer in charge of Sewers, Detroit, Mich.
Edward B. Codwise, City Engineer, Kingston, N. Y.
R. W. Ball, City Engineer, Henderson, Ky.
Allan W. Dow, Consulting Chemist, 120 E. 23d St., N. Y.
Frank A. Hinds, Consulting Engineer, Watertown, N. Y.
Geo. G. Earle, General Supt. Sewerage and Water Board, New Orleans.
L. H. Weissleder, Consulting Engineer, Cincinnati O.
W. H. Gainey, City Engineer, Valdosta, Ga.
John M. Monie, Municipal Engineer, Bonne Terre, Mo.
Geo. W. Fuller, Consulting Engineer, 170 Broadway, New York.
R. E. Meade, Consulting Eng, 1520 Brown-Marx Bldg., Birmingham, Ala.
Frank J. Bock, Commissioner of Public Works, Newark, N. J.
Arthur R. Denman, Commissioner of Public Works, Newark, N. J.

ASSOCIATE MEMBERS.

A. L. Barber Asphalt Co., 17 Battery Place, New York City.
Barrett Manufacturing Co., 17 Battery Place, New York City.
Clements, L. L., U. S. Wood Preserving Co., Mercantile Library Bldg., Cincinnati, O.
Davis, Robert K., Hammond Building, Detroit, Mich.
Donaldson, John, Southern Bitulithic Paving Co., Birmingham, Ala.
Engsfeld, G. C., Southern Paving & Construction Co., Birmingham, Ala.
Hutchinson, F. S., 17 Battery Place, New York City.
Lasley, T. H., Vice-Pres. Southern Clay Manfg. Co., Chattanooga, Tenn.
Lasley, W. M., Pres. Southern Clay Manfg. Co., Chattanooga, Tenn.
Mead, A. J., Reinforced Concrete Pipe Co., Jackson, Mich.
Parker, R. H., Southern Clay Manfg. Co., Chattanooga, Tenn.
Reinforced Concrete Pipe Co., Jackson, Mich.
Rock, J. C., 17 Battery Place, New York City.
Southern Cement Co., Birmingham, Ala.
Tenney, Geo. O., Pres. Atlantic Bitulithic Paving Co., Spartanburg, N. C.
Warren, Ralph, 93 Federal St., Boston, Mass.
White, W. W., Reinforced Concrete Pipe Co., Jackson, Mich.
Wilson, John A., 902 First National Bank Bldg., Nashville, Tenn.

THE PRESIDENT: You have heard the list, shall they be elected?

MR. SHERRERD: I move that the Secretary cast the vote of the Association for the election of the members.

Motion seconded and was carried.

THE PRESIDENT: We have now the report of the Committee on Resolutions, which will be presented now by Mr. Hatton, the chairman.

WHEREAS, His Honor, the Mayor and Board of Aldermen of the City of Birmingham have so kindly and courteously placed the city hall at the disposal of the Society as a place for holding its Annual Convention, and have extended to its members an open house with the key in our possession, and have shown the members of the Society, both individually and collectively, the most unbounded hospitality; and,

WHEREAS, The Birmingham Water Works Company entertained the Society by showing its members the extensive, interesting and well kept plant of the said company, and threw in as a very much appreciated side issue an old-fashioned southern barbacue, which was partaken of with great pleasure by the Society; and,

WHEREAS, The Louisville & Nashville Railroad Company entertained the Society most instructively by carrying its members, by special train, through the coal and iron industries of the Birmingham district; and,

WHEREAS, The Birmingham Railway, Light and Power Company extended the freedom of its railway service to the members of the Society during its convention; and,

WHEREAS, The Birmingham Athletic Club kindly extended the privileges of its very beautiful club house and appurtenances to the Society; and,

WHEREAS, The citizens of Birmingham, through the Commercial Club, have extended the greatest hospitality to the Society, throwing in a beautiful drive over the mountains to the waterworks station, a bountiful and continuous luncheon during the railroad trip around the horn, and in many other ways thus making our visit to the City of Birmingham one long to be remembered by every member of the Society whose privilege it has been to attend this annual convention and who will carry home with him a much broader idea of the present magnitude of the industries of the city and of its great future importance to this republic, which city, however, is no bigger than the hearts of its people;

Now, Therefore, Be it Resolved by the American Society of Municipal Improvements that its heartfelt thanks be extended to his Honor, the Mayor and Board of Aldermen; to the Birmingham Waterworks Company; to the Louisville & Nashville Railroad Company; to the Birmingham Railway, Light and Power Company; to the Birmingham Athletic Club; to the citizens of Birmingham through its Commercial Club, and particularly to Birmingham's most efficient city engineer, Mr. Julian Ken-

drick, for the courteous and extreme hospitality thus extended to this Society, which have been the principal means of making this convention one of the most profitable ever held; and,

Be it Further Resolved, That the Society appreciates the earnest efforts of Mr. R. K. Davis, chairman of the Exhibit Committee, and the several exhibitors who have so kindly placed their exhibits in the exhibition hall for the benefit of the members of this Society, which display has been very interesting and instructive to the several visiting members, and it is hoped that this feature of the annual convention may be continued and enlarged upon in the future to the advantage of both the members of the Society and to the exhibitors.

The Society further extends its appreciation to the press of Birmingham for the liberal space which has been daily given to the Society's proceedings. (Signed)

T. CHALKLY HATTON,
FRED GIDDINGS,
J. S. VINSON,
Committee on Resolutions.

MR. HATTON: Mr. President, in furnishing this report I wish to add just a little paragraph to that resolution, and that is with respect to Mr. Julian Kendrick's kindness to the Society. The committee felt that they did not want to put too much in there, knowing Mr. Kendrick's unusual bashfulness, and feeling that if we did say too much, it would scare him from going to the Detroit convention, but every member of this convention has appreciated Mr. Kendrick's untiring efforts for our pleasure, in showing us everything about the town, and his social as well as personal courtesy, without which we would not have had half as much pleasure in this convention as we have had. (Applause.)

THE PRESIDENT: You have heard the report, what shall be done with it?

MR. OWEN: I second the adoption of that report. Even, gentlemen, they so far favored us, that when we Northern people came down here they gave us the cold weather like we are used to to prevent what they call the Southern tired feeling. I don't think we have had any tired feeling, and while I say that, I want to express my keen appreciation at the magnitude and growth of the City of Birmingham. There is no Southern tired feeling here, and when I

recall the time far back when I visited this city, when real estate was down, and look at the development of this city in the last few years, it seems to be a marvel to the United States, and in saying that I want to pay my tribute to the City of Birmingham. (Applause.)

THE PRESIDENT: Any further remarks. If not, those in favor of the motion will please rise.

(Motion unanimously adopted by rising vote.)

THE PRESIDENT: Now, gentlemen, it comes time to close the convention, and I want to say just a word or two in retiring from the office. I want to thank the chairmen of the various committees for the splendid work they have done in preparing the program and also the members of most of the committees who have done their share and the members of the Society who have come forward on the request for the papers on the program, and I desire to thank the members of the board and the members of the Society generally for the support they have given me. Our new President is a man of very much courage and he is going to show his energy at the very beginning and I am sure that you will have a very prosperous year under him. If you will support him as manfully as you have me, I am very sure of it. I very heartily welcome him to the chair which I vacate. (Applause.)

MR. SHERRERD: Mr. President and members of the American Society of Municipal Improvements. Before making announcement of the committees, which I think it would be wise to announce at this early time, in order that the work for next year's convention may be taken up at once, I wish to thank the Society for the honor which it has done me in my selection as your presiding officer. I have had the interest of this Society at heart for the ten or eleven years I have been a member, and during that time have only missed one meeting, the Milwaukee convention. I want to ask in assuming the duties of this office that I may have the cordial support of the members of the Society, and particularly do I think that each one can aid by trying to interest the people in the municipalities in

their immediate vicinities to join this Society. At Detroit, Mich., I think that we will be able to materially increase our membership, and knowing as I do the value of the papers that have been presented to this Society, and the good it has done those who have attended this meeting, I believe we ought to show to our brother engineers and those interested in municipal matters the advantages of joining the Society, and I believe with due effort we can have a rousing meeting in Detroit. I would take this opportunity to announce the tentative suggestion of the membership of the committees.

(Here the President read a partial list of the committees.)

PRESIDENT: Is there any further business before the Association?

MR. OWEN: I would like to move a vote of thanks to our retiring President, Mr. Brown, for his energy and industry in the management of this Society during the last year. It will make him appreciate somewhat the work he has done.

Motion received a second and carried.

THE PRESIDENT: Before declaring the convention adjourned, I would like to say that in my experience in these kinds of gatherings, the work of the Society devolves almost entirely during the interim on the Secretary, and I accept this naturally from your hands feeling that with the efforts the Secretary has always given the Society, its work will progress in the same ratio in the future as it has in the past. (Applause.)

MR. HATTON: Mr. President, it is not necessary to give a vote of thanks to the Secretary, for everybody who has been connected with the Society knows of the good work he has done, and it would be out of order.

MR. REIMER: I move that we adjourn.

THE PRESIDENT: I make the announcement that the Executive Committee have considered the time for holding the next convention, and have decided that it would be advisable to advance the date slightly from the date fixed in the constitution, and we would

therefore announce that we have fixed the third Tuesday in September as the date for holding the next annual convention. If there is no other business, I will declare the convention adjourned until said date.

EXHIBITION

The exhibiton by the associate members was held on the same floor of the City Hall as the Convention. The room was decorated very tastefully, and the exhibits were all good. This exhibition is getting to be one of the features of the Society's meeting, and it is to be hoped it will be more largely attended in the future. The exhibitors and exhibits were as follows:

The Bitulithic Pavement, paving materials, sections of pavements, photographs of work, samples of Puritan sanitary flooring and of their slushing compounds.

A. L. Barber Asphalt Company, samples of Bermudez asphalt and photographs.

The Birmingham City Laboratory, biological exhibit, cultures, etc.

The Reinforced Concrete Pipe Company, samples of 30-inch pipe and photographs.

The Municipal Journal and Engineer.

Graves Shale Paving Brick Company, of Birmingham, samples of brick and shale.

American Wood Preserving Company, wood paving blocks.

The Barrett Manufacturing Company, tarvia and photographs of tarviated roads.

The Thompson Meter Company, assortment of water meters.

The Southern Clay Manufacturing Company, paving brick and blocks, and photographs.

The Southern Cement Company, samples of "Alabama Portland" and "Magnolia" slag cement.

The Southern Sewer Pipe Company, pipes and other clay products.

APPENDIX

THE WATER WORKS OF ARCHANGEL, RUSSIA.

BY U. TOWBENHEIM, MANAGER, CITY WATER WORKS.

We hardly find any data at all in American literature concerning water supply in Russia, and it therefore seems to me that a description of the water works, constructed at Archangel, in the far North, may be of some interest.

The specialist will find sundry shortcomings in this plant from a technical point of view, but it must be borne in mind that this water supply was constructed with the object of satisfying the altogether exceptional local condition with a minimum of capital. The consequence of this last condition being, as might be expected, a minimum of success.

The construction was commenced by the writer in the spring of the year 1902, and completed in May, 1903.

GEOGRAPHICAL POSITION AND CLIMATE.

Archangel is situated in 64° 33′ north latitude and 40° 32′ east longitude on the right shore of the Northern Dwina, at a distance of twenty-six English miles from its outlet into the White Sea, and has a population of 21,000 inhabitants. Of this number 13,000 live in the town and 8,000 on a suburban island called Solombola.

The elevation above mean water level varies from 14 to 20 feet. The marshy ground on which the town is built is locally called "tundra," and reaches a depth of about 21 feet, clay following lower down.

The town being situated within two degrees of the polar circle, the climate is severe, being at the same time subject to great contrasts. The average yearly temperature equals .3°C (32.5°F.), with a maximum of 34.4°C (93.9°F.), and a minimum of —47.5°C (—53.5°F.). These readings are based on observations extending over the last 20 years. The river is covered with ice from October until the end of April.

The mean annual precipitation is on an average about 16 inches.

The length of the day in June is 21 hours, and in December 4 hours.

LOCAL CONDITIONS WITH REFERENCE TO WATER SUPPLY.

The town contains a total of 1,150 buildings of from one to two stories, and they are situated on an area of 3.125 x .5 miles, *i. e.*, 1.56 square miles. It practically consists of one long street, an arrangement rather advantageous with regard to fires.

There are hardly any industrial concerns in the town itself. All the mills are built farther down the river, on separate islands which are of no interest to us, since they are not included in the region of the action of the water supply.

Owing to the absence of a sewerage system, the consumption of water is surprisingly insignificant; even the number of water closets and bath rooms is limited, in view of its being necessary to direct the waste into cesspools, from whence it is carted away in the most primitive manner.

The type of closet in general use consists of a seat, made of several boards, nailed together in some cold passage or shed and connected by means of a straight wooden pipe, with the cesspool located under the floor. This system is even used in connection with two-story houses. Only in the end of last year water closets and bath tubs were put up in the local hospital. The care of matters hygienic is intrusted to the frost.

The arrangement of house water supply usually consists of a tap placed in the kitchen, and that is all. The kitchen slops are carried out in pails to a cesspool, located in the yard not far from the house.

There are two public bath houses in the town, of which one is supplied with water from the water supply. The other one is fed with water directly from the river and the suction pipe is laid so skillfully that it often becomes choked with sand and slime. A third bath house, which took water directly from the swamp, ended its existence recently.

Linen is rinsed in the river; in winter holes are made in the ice for this purpose, and kept clear by special attendants who get a certain payment from each family.

Watering the streets is almost unnecessary during the short summer time, as the ground is sufficiently moist without it. The outlying streets tail off into the marsh, where a horse may easily be drowned within a few yards of the houses.

When the foregoing facts are taken into consideration the exceedingly small average daily consumption of water, *i. e.*, 6½ U. S. gallons per inhabitant, becomes easily comprehensible.

There is little need for taking the future density of the population into account, as its growth, amounting to 112 inhabitants per annum (*i. e.*, 701 births to 589 deaths) is insignificant; and if 38 per cent. be deducted on account of the industrial region, which, as has been stated above, is not supplied with water and to which it is not even proposed to extend the water supply in future, the growth of the population will in reality come to only 70 people per annum.

The population is not appreciably increased by the arrival of newcomers, since local trade and industry are at zero.

Political exiles form only a temporary element of the population and the insignificant consumption of water by them may be ignored.

We have favorable conditions for laying the pipes. The soil is moist and marshy and this fact was taken into consideration in determining the depth at which the pipes should be laid. In the winter time an icy cover-

ing is formed, reaching a maximum thickness of 5 feet, the soil below this depth not being affected by the frost. The pipes are therefore laid at a depth of 7 feet 6 inches. During the summer all the frozen soil thaws, so that the frost has no time to reach a greater depth. There are only inconsiderable strips of ground situated in the outskirts of the town, near the shore, at both ends of our district, where the layers of clay reach the surface of the ground; here the soil freezes down to 9 feet 3 inches deep and the pipes are laid at a depth of 12 feet 10 inches.

During the three years of the existence of the water supply there has not been a single case of freezing of the mains.

With the arrangement of a sewerage system the level of ground water would become lower, in view of which fact the soil would freeze deeper than under the present conditions, but it may be stated with certainty that there is no hope for the arrangement of a sewerage system even in the distant future.

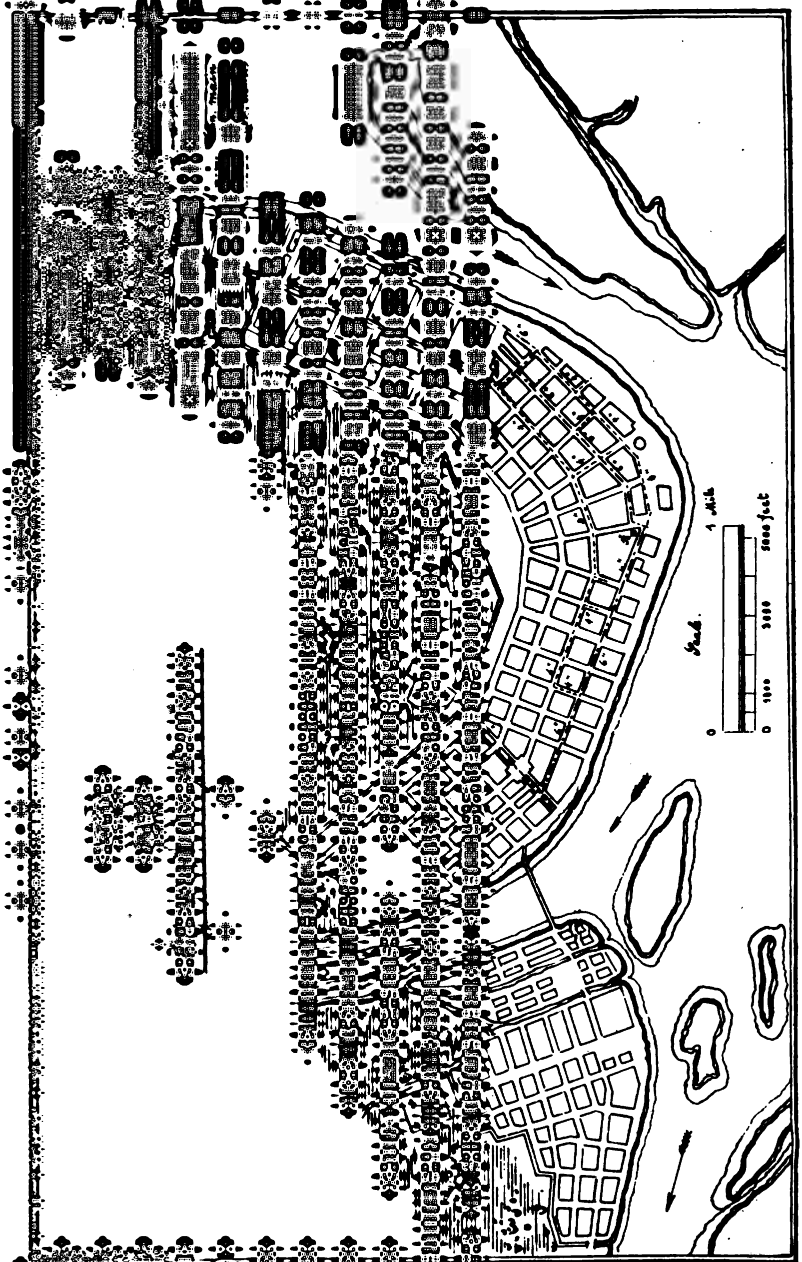
Surface drainage was arranged in sundry places about 10 or 15 years ago, but it was made with incorrect inclines and therefore serves more to collect water than to dry the locality.

The waterworks are owned by the town and the income does not even cover half the expenses. This is due to the fact that water is furnished to the consumers unmetered, and that up to 20 per cent. of the daily pumpage has to be given free of charge. The latter right is enjoyed, according to law, by all soldiers and gendarmes, commencing with the officers and ending with the lowest ranks, inclusive; besides this, water must be supplied gratis to many schools, charitable institutions and hospitals. During the three years of the existence of the water supply, not a single cent has come in for the use of water from the Governor. No payment is made by insurance companies for the insertion of fire hydrants.

ARRANGEMENT OF WATER SUPPLY IN HOUSES.

Most of the houses are built of wood and the floor of the bottom story is situated at a distance of from 2 to 6 feet from the ground. The space below the floor is generally not occupied by anything and therefore warm basements are a rarity. The pipes are laid in the following manner: a branch, taken from the street line, is placed under the foundation of the building on a level with the existing mains and is brought up through the basement space at a distance of 2 feet from the exterior wall. A wooden casing of not less than 3.5x3.5 feet cross-section is placed round this part of the pipe. This box is filled with manure mixed with hay, and covered with a thin layer of lime and the last foot under the floor is filled with ashes. All this is covered by a detachable hatch, so that in case the isolating materials should settle, an additional supply of the same may be put in.

As it is difficult to get to the curb cock in winter, owing to the depth of snow, a second stop cock is placed at the entrance of the pipe into the room.


Scale
1 Mile
0
1000
2000
5000 feet

Every house has sundry outbuildings in its yard, to which, from motives of economy, water pipes are not usually led, but an outlet is arranged in the wall of the main building, from which water may be drawn for the requirements of these outbuildings.

In order to accustom the inhabitants to make use of water from the water supply, no restraint is laid on them by the installation of a water meter. A yearly payment of 75 cents for each dweller, excluding children, is taken from householders, who have water supplied to their premises. The consumption of water is not limited in any way at all.

SYSTEM OF THE WATER SUPPLY.

The Northern Dwina is the best source of water supply available for the town. The water is of excellent quality, being free from organic impurities. It is tasteless and odorless, but as the water shed is not free from swamps, the water has a slight yellow color. The water is free from hardness and answers favorably every practical demand for domestic use. American filters would have been the most suitable for such water, but on account of the prejudice on the part of the Municipal Council, filters of the English system had to be installed.

Analysis of filtered water gave the following results: 3° German hardness, no traces of either nitrates or nitrites, no ammonia or chlorine. Oxygen required to oxydize organic matter—per litre 14.9 milligrams. In 1 litre of water there were 4.7 milligrams sulphuric acid and in 1 cubic cm., 83 bacteria.

The pumping station is situated outside the town, a short distance up the river, and the pumps deliver water into the town by means of two main supply pipes. The water tower is located in the center of the town. During fires the tank is excluded from the system and by direct pumping the pressure is raised to 7 atmospheres. This pressure may be increased in case of necessity, as the street mains were tested at 10 atmospheres.

The whole installation consists of:

(1.) A stone engine house, roofed with sheet iron.

(2.) An English filter covered with arches, all built of bricks on cement.

(3.) A reservoir for filtered water, built of bricks on cement.

(4.) A stone water tower with an iron tank.

(5.) An electric signaling device.

(6.) A wooden building for employes.

(7.) Eight public water supply stations.

(8.) Two steam pumps for river water and two similar pumps for filtered water.

(9.) Two steam boilers of the Cornwall type.

(10.) Street mains consisting of 6 and 4-inch pipes with fire hydrants and stop gates.

Thus the total depth of the filtering layers is equal to 3 feet 9 inches. The filters, when working normally, deliver 97,500 gallons of water in 24 hours, but during tests the speed of filtration was brought up to 195,000 gallons, the water thus filtered being fully suitable for household requirements.

The drainage of the filters consists of canals, constructed of bricks laid dry.

The ventilation pipes are placed in chess-board fashion.

The filters are cleaned every two or three days during the spring, but only every two months during the rest of the year.

A fresh layer of sand is added after every cleaning, so that the thickness of the filtering layer always remains the same.

BASIN FOR FILTERED WATER.

This is a round reservoir, covered with a dome, all built of brick on cement underground. The floor is of concrete as in the filters. The capacity of the basin equals 32.500 gallons. The water from the filters enters through a 6-inch pipe. An 8-inch suction pipe is laid to the pumps delivering water into the town. A shaft is arranged for purposes of inspection. In winter it is filled with straw, closed on the top by a cover, on which snow is heaped.

An unpleasant incident occurred during the erection of the basin. A pit for the basin was successfully dug out and the building of the walls had commenced when one day a heavy rain, such as rarely occurs in this locality, commenced. The earth wall fell in and filled up the pit. An octagonal wooden framework had to be made in order to render the completing of the brickwork possible.

WATER TOWER.

The building of a water tower was avoided in the following manner: There is a fire watch tower, 77 feet in height, in the center of the town, above the Police Office; the roof was taken off this tower and an iron tank 9 feet in diameter and 14 feet high was installed there. On putting up the tank the walls of the tower were raised 16 feet 4 inches and a roof with a fireman's watch-cabin was erected above the tank. The insignificant capacity of the tank, *i. e.*, 6,500 gallons, is due to the small dimensions and slight strength of the existing tower. The tank is of cylindrical shape and is composed of iron sheets ⅛ of an inch thick; it is painted on the inside with carbonizing coating of the Goheen Manufacturing Co., Canton, Ohio, U. S. A., and with red lead on the outside.

A 6-inch pipe delivers water into the tank and serves at the same time as a feed pipe for the town.

A 4-inch pipe is connected to the 6-inch overflow pipe for washing the tank.

The tower is situated at a distance of 2½ miles from the pumping station.

In the winter time the tower is heated and serves to dry the fire hose.

ELECTRIC SIGNALIZATION.

To record the level of the water in the tank at the pumping station a system of electric signals is arranged. An inductor is installed at the pumping station and four wires are directed from it to four floats, placed in the tank to indicate ¼, ½, ¾ and a full tank. Besides this an alarm signal is given by an automatic bell, when the pressure in the town system falls below 20 pounds.

BUILDING FOR EMPLOYES.

This building, intended for the engine room staff, is built of wood and roofed with sheet iron. It stands on a stone foundation and is 56 feet in length, 28 feet in width and 12 feet 3 inches in height. It is situated near the pumping station.

PUBLIC WATER SUPPLY STATIONS.

The public water supply stations, numbering eight in all, are built of wood; some of them were constructed on stone foundations, others on piles, as the quality of the soil permitted. They are located in different parts of the town and are intended principally for supplying water to the poor class. Each station is equipped with a 1½-inch wall outlet for taking water by means of barrels, and another 1-inch pipe for taking water with pails. The station consists of one room, which serves as a dwelling place for the watchman.

Water from these stations is given to holders of tickets, which are paid for or obtained gratis. These tickets are issued by the Municipal Board.

STEAM PUMPS.

Two sets of steam pumps are installed, one of which is in reserve. Two pumps with steam cylinders 7½ inches in diameter, pump piston equal to 8 inches and stroke of 16 inches, serve to deliver river water to the filters, and two others, the dimensions of which are 13x8x16 inches, deliver filtered water into the town. These pumps are of double action with fly-wheels, the water cylinder being of the Worthington type and the admission of steam by Meyer's slide valves, with expansion. The pistons are fixed on one general rod; the water pistons being fastened on one end and the steam piston on the other. Each pair of pumps has one general air chamber 1 foot 9 inches in diameter and 5 feet high.

The steam, suction, and part of the delivery pipes are located below the floor.

The pumps are able to deliver up to 16,000 U. S. gallons per hour. The suction pipes are 8 inches in diameter and the delivery is 6 inches. The intake pipe is laid at a distance of 280 feet from the engine-house and the top of the outer end of this pipe is 7 feet below the zero level of the river. The check-valve is situated on the bank in a separate well. In the case of the river pipe becoming choked up, it may be washed by reverse pressure. The laying of the suction pipe was performed in the following manner: Two rows of pontoons were put up in the river in such a way

that a space of 3 feet was left between them. A scoop was used for digging the trench and two workmen pushed it into the soil. A rope was directed from the ladle to a winch and as the rope was wound the workmen with the ladle proceeded further. In this way a trench 3 feet 6 inches in depth was dug in the river ground.

The suction pipe was made up of 8-inch cast-iron socket pipes, which were connected with lead joints and adopted the outline of the river bed. After caulking, the whole line was tested at 10 atmospheres and gradually lowered down to the bottom of the river by means of winches.

The strainer and part of the pipe are surrounded with cobblestones, and as the flow of ice down the river is sometimes very powerful, the pipe is protected on the sides by piles.

STEAM BOILERS.

The steam boilers are of the horizontal Cornwall type with a heating surface of 250 square feet and for a pressure of 6 atmospheres. Two boilers were put up, one of which is reserve. The diameter of the boiler is 4 feet 6 inches, the diameter of the welded flue 2 feet 5 inches and the length 14 feet 9 inches. The thickness of the boiler plates is ⅜ inch and the front plates are ½ inch. The boilers are fed with filtered water by means of two injectors. The maximum and minimum water-levels are indicated by "Amphlet" whistles. The furnaces are arranged for wood.

STREET WATER SUPPLY SYSTEM AND FIRE SERVICE.

The street mains consist of 6 and 4-inch cast-iron pipes, coated with asphalt according to the system of Angus Smith and connected together by means of lead joints. The pipes are laid at a depth of 7 feet 6 inches. At both ends of the town the pipes are laid in clay soil and in the center part they are located in a swamp, so that the mains form a chain, fastened on both ends. As the marshy soil cannot serve as a steady basis for the pipes, the back-filling is made in such a manner that the weight of the earth should press on only part of the pipes.

This is attained by digging the trenches not as continuous ditches, but with intervals. Ditches of 14 feet in length have intervals of 4 feet between them and openings are made at the bottom of these earthen walls for the passage of the pipe. In covering the pipes the earth presses only on the pipes in the ditches and the spaces which were not dug up from earthern arches, these latter not producing any pressure on the pipes.

The water is delivered into the town by means of two 6-inch mains, surrounding the district of the poor class of inhabitants; in the central part of the town one 6-inch line is laid with two parallel 4-inch pipes and at the end of the town, where the population is less and where there is more free space, one 6-inch line and another 4-inch are laid. Cross mains are being laid as means are obtained.

Stop-gates are installed 1,700 feet apart; besides this there are two drain cocks. Hydrants for hose 2½ inches in diameter are located at intervals of 350 feet directly above the mains.

A red lantern is put up on the pavement opposite the hydrant, and as the streets are covered with a thick layer of snow in the winter time, a rope is made use of for finding the hydrant quickly; this rope being kept in the lamp-post, and in case of necessity it is stretched out up to a post placed on the opposite side of the street; a lead ball is fixed on the rope directly over the place where the hydrant is installed, so that it is easy to find the hydrant even in the dark. This fact is of special importance as the lighting of the streets in the winter time is fulfilled by snow and moon.

The fire signaling consists in watching from three towers, to see if any smoke and fire should appear on the exterior of some building. As no less than 5 to 10 minutes and sometimes more must elapse from the moment the fire starts until it breaks out on the exterior of a building, and taking into consideration that the drive of the brigade to the fire will require not less than 5 minutes, it is surprising that we have but little loss by fires.

Frequently the watchmen on the towers, especially during the night, doze, and sometimes simply fall asleep. It is necessary to have special men to keep control over them and these latter frequently also doze somewhere in a corner. In view of this, the man on duty has to be watched by the fire chief. Besides this, the maintenance of watch service on the tower involves considerable expense. If the watchmen on the towers in our town were abolished and electric fire signaling arranged, the expenditure for an installation of this kind would pay for itself in a period of four years.

The firemen are frequently changed and owing to the paltry salary, amounting to six or seven and one-half dollars per month, drunkards are almost exclusively taken on who have not the least idea about the construction of a hydrant.

Notwithstanding all this the maximum loss from fire for two years does not exceed $6,500.

COST OF LAYING 6-INCH PIPES.

Cost of 6-inch cast-iron pipe, per foot	$0.63
Cost of lead, per foot	.03
Laying, yarning, pouring, caulking	.06
Trenching, bell-holes, back-filling	.19
Total per foot	$0.91

COST OF LAYING 4-INCH PIPES.

Cost of 4-inch cast-iron pipe, per foot	$0.38
Cost of lead, per foot	.02
Laying, yarning, pouring, caulking	.05
Trenching, bell-holes, back-filling	.19
Total per foot	$0.64

APPENDIX A1.

TOTAL COST OF WORKS.

(1.) Engine house with chimney	$ 3,975.00
(2.) Filters with pipes, grates, etc	5,775.00
(3.) Reservoir for filtered water	1,040.00
(4.) Superstructure of water tower with tank, pipes and gates	1,500.00
(5.) Electric signalization from water tank to pumping station	750.00
(6.) Building for employes	1,000.00
(7.) Eight public water supply stations at $300.00	2,400.00
(8.) Four steam pumps with all the pipes inside the building, at $1,500.00	6,000.00
(9.) Two steam boilers at $1,250.00	2,500.00
(10.) Street water supply system:	
(a.) 6-inch cast-iron pipes, 30,198 feet, at $0.91	27,480.18
(b.) 4-inch cast-iron pipes, 18,962 feet, at $0.64	12,135.68
(c.) 98 hydrants at $48.00	4,704.00
(d.) 49 stop-gates at $40.00	1,960.00
(e.) Two drain-cocks and 1 air valve	110.00
Total	$71,329.86

APPENDIX A2.

EXTRACT FROM ORDINANCE RELATING TO THE WATER DEPARTMENT.

(1.) If the premises, in which it is desired to have water service, are located in a street not having a water supply main and are more than 100 feet distant from the nearest main, then a cast-iron street main must be laid along the street. If the distance to the main is less than 100 feet, then the laying of an iron pipe of small size is permitted.

The laying of the street mains is done by the city employes at the expense of the owner of the building, on condition that the municipality undertakes to pay back these expenses with water, *i. e.*, the payment of schedule rates is not taken until the whole amount invested by the owner is covered by such deductions.

In case of branch pipes being directed from such a main to the neighbor's, these latter must pay an amount proportional to the previous cost, and this money is used to cover the expenses incurred by those who paid the amount for the laying of the street main primarily.

(2.) Our practice is to tap the main and lay the service pipe to the curb box at the expense of the owner of the building.

Galvanized iron pipes not less than 1 inch in diameter have to be used, and for sizes of 3 inches and more, cast-iron ones.

The consumer agrees not to supply water to neighbors or allow them to take it, also that water will not be allowed to run to prevent freezing.

(3.) If the owner and the occupant of the premises in which water

is used fail to keep the pipes and the fixtures in good order, the water shall be cut off until the waste is stopped.

(4.) All service pipes shall be laid by the municipality and repaired at the expense of the city.

APPENDIX A3.

SCHEDULE OF WATER RATES.

(1.) The annual rate for water is fixed as follows:
- (a.) For each consumer (excl. children).....75 cents
- (b.) For a water closet, additional.....62½ cents
- (c.) For a bath tub, additional.....62½ cents

No payment is taken for children younger than 10 years.
- (d.) For each horse or cow.....75 cents

(2.) From schools, for each 1,000 vedros (3,250 gals.).....50 cents

(3.) For industrial purposes, if the daily water consumption exceeds 3,000 vedros, for each 1,000 vedros.....62½ cents

If the consumption is less than 3,000 vedros, for each 1,000 vedros .....75 cents

(4.) Payment at the public water supply stations:
- (a.) Per barrel at 40 vedros (130 gallons).....2½ cents
- (b.) Per tub at 4 vedros (oushat).....¼ cent
- (c.) Per vedro (3.25 gallons).....1-16 cent

To the poor class presenting tickets, which are distributed by the municipality, water is given free of charge.

APPENDIX A4.

SUMMARY OF STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1905.

Population 13,000
Date of construction.....1903
By whom owned.....City of Archangel, Russia
Source of supply.....Northern Dwina
Mode of supply.....Pumping

PUMPING.

(1.) Builders of pumping machinery...D. Linowieff & Co., Narva, Russia
(2.) Fuel used .....Wood
(3.) Total pumpage of filtered water for the year in gallons, without allowance for slip.....31,741,460
Cost of pumping, figured on pumping station expenses, viz...$4,408.00
(4.) Per million gallons pumped.....139.05
Cost of pumping, figured on total maintenance, viz.....$9,824.00
(5.) Per million gallons pumped.....$309.90

FINANCIAL STATEMENT.

Receipts.		Expenditures.	
A. Water rates	$2,372.17	A. A. Management and repairs	$4,408.00
B. From other sources	1,674.83	B. B. Interest and payment of bonds	3,612.50
Total	$4,047.00	C. C. Extension of mains	898.73
Balance	5,777.00	D. D. Extension of services	904.77
Total	$9,824.00	Total	$9,824.00

Net cost of works to-day, $71,329.86.

CONSUMPTION.

(1.) Estimated population at date	13,000
(2.) Total pumpage for the year in gallons	31,741,460
(3.) Feed water	446,130
(4.) Total consumption for the year	31,295,330
(5.) Passed through meters (excl. feed water)	2,461,550
(6.) Average daily consumption in gallons	85,741
(7.) Percentage of consumption metered	7.8 per cent.
(8.) Gallons per day to each inhabitant	6.6
(9.) Gallons per day to each tap	144.6

MAINS.

(1.) Kind of pipe	Cast-iron
(2.) Sizes	From 4 to 6 inches
(3.) Extended during year	1,500 feet
(4.) Total now in use	8¾ miles
(5.) Cost of repairs per mile	$0.35
(6.) Number of leaks per mile	⅔
(7.) Number of hydrants now in use	98
(8.) Number of stop-gates now in use	48
(9.) Range of domestic pressure on mains	39 to 47 lbs.
(10.) Fire pressure	7 atmospheres

SERVICES.

(1.) Kind of pipe	Galvanized iron and cast-iron
(2.) Sizes	1 inch to 3 inches
(3.) Number of service taps now in use	475
(4.) Average length of service	35 feet
(5.) Number of meters now in use	5

APPENDIX A5.

STANDARD METRIC ASSORTMENT OF CAST-IRON WATER SUPPLY PIPES COMPUTED BY THE COMMITTEE OF THE FIVE—RUSSIAN WATERWORKS CONVENTION OF THE YEAR 1901.

WORKING DRAWING.

The standard assortment is based on a strictly metric basis, *i. e.*, the sizes of the pipe diameters correspond with the character of the system and are not attained by transferring inches into millimetres multiplying by 25.

The number of types of pipes in the standard assortment is considerably less than in the German standards, in view of which fact the interests of the producers as well as of the users are looked after; an excess number of types, on the one hand, overburdens the pattern stores at the works, and on the other the stores of special castings of the users.

Success of technical art in the foundry business has made possible the establishment of the thickness of pipe shells for pipes from 40 to 3,000 mm in diameter, according to the formula $d = .02D + 6.5$ mm and for pipes from 350 to 1,200 mm in diameter according to $d = .02D + 6$ mm.

COMPARATIVE THICKNESS OF METAL IN THE BODY OF THE PIPE OF STANDARD RUSSIAN AND GERMAN ASSORTMENTS.

Inside Diameter D	Thickness of Pipe Shell δ		Inside Diameter D	Thickness of Pipe Shell δ		Inside Diameter D	Thickness of Pipe Shell δ	
	Russian Assortment	German Assortment		Russian Assortment	German Assortment		Russian Assortment	German Assortment
40	7.5	8	225	11	11.5	700	20	19
50	7.5	8	250	11 5	12	750	21	20
75	8	8.5	300	12 5	13	800	22	21
100	8.5	9	350	13	14	900	24	22.5
125	9	9.5	400	14	14.5	1000	26	24
150	9.5	10	450	15	15	1200	30	28
175	10	10 5	500	16	16	.....	.....	.....
200	10 5	11	600	18	17	.....	.....	.....

The variations of the thickness of the pipe shells of the two assortments are shown in the next figure.

(Figure Tracing.)

In determining the thickness of the pipe shell, it is impossible to base the calculations on the theoretical figures exclusively, it being necessary to consider combinations of practical character, *i. e.*, the possibility of casting a pipe of a determined thickness correctly, the convenience of transporting and laying, the effect of rust, etc.

If the pipe is considered as a hollow cylinder with internal pressure (Bach, Details of Machines, page 31, edition of 1897), we obtain the term for the exterior radius r_a

$r_a = r_1 \sqrt{\frac{K_z + .4\,P_1}{K_z - 1.3\,P_1}}$, where K_z is the tensile stress

P_1 — interior pressure

r_1 — interior radius of pipe.

Accepting $K_z = 200$ kilagr. per square cm., and $P_1 = 10$ kilagr. per square cm. $r_a = 1.044\ r_1$

$\delta = r_a - r_1 = .044\ r_1 = .022D$ (D interior diameter of pipe), but in view of the above mentioned reason, this theoretical formula reverts into an empirical one of common form $\delta = f(K, P_1, D) + C$, where C depends on the technical art of the foundry business, convenience of transport, etc. The amount C may be looked upon as the sum of three items: C_1 (allowance for imperfect casting), C_2 (allowance for rusting) and C_3 (allowance for purposes of handling and transportation).

$$C = C_1 + C_2 + C_3$$

C_1 may be decreased as the exactness of casting has increased.

C_2 may be considered almost equal to naught; water supply pipes, asphalted according to Angus Smith's system, as proved experimentally by W. Lindley, are not subject to rust and have a surface quite as smooth as when they were laid in the ground twenty years ago.

C_3 may likewise be decreased partly, owing to the fact that the standard pipes now offered, being thicker on their ends, are more safe from damage in transport.

Having regard to the aforesaid consideration the amount C, when computing the standard Russian assortment, was accepted at 6 and 6½ mm.

In making the outline of the socket, it is needful to maintain fluency of the bends from the thin places to the thick ones, as otherwise it will not be possible to attain an even distribution of material in casting.

The socket must give, on the one hand, flexibility in the joint, and, on the other, guarantee tightness of the connection. These two demands are not satisfied by a deep socket which always decreases the flexibility of the pipe line; besides this, more material is required for the joints when a deeper socket is used. Having regard to this, the depth of the socket is determined according to formula $l = 60 + .04D$.

The length of the transition of the shell into the socket —f, is determined according to formula $-f = 60 + .06D$.

The other sizes for outlining the socket are shown on the working drawing.

The length of the socket pipes is accepted as follows:

For diameters of 40 to 50mm—2 metres.

For diameters of 75 to 300mm—3 metres.

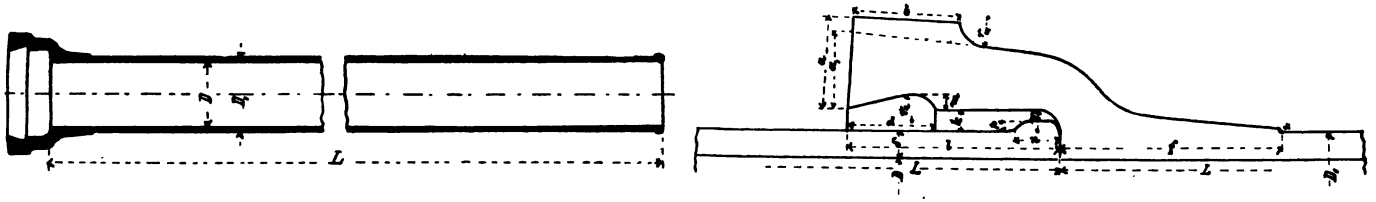
For diameters of 350 to 1200mm—3.75 metres.

The casting of straight pipes of standard length is vertical, without lengthwise seams and with the socket downwards.

The thickness of special castings is increased 20 per cent. as compared with the standard thickness of the pipe, as the specials are cast horizontally, it being difficult to attain an even thickness of the shell with such a method of casting.

APPENDIX A6.

STANDARD CAST-IRON BELL AND SPIGOT PIPE.

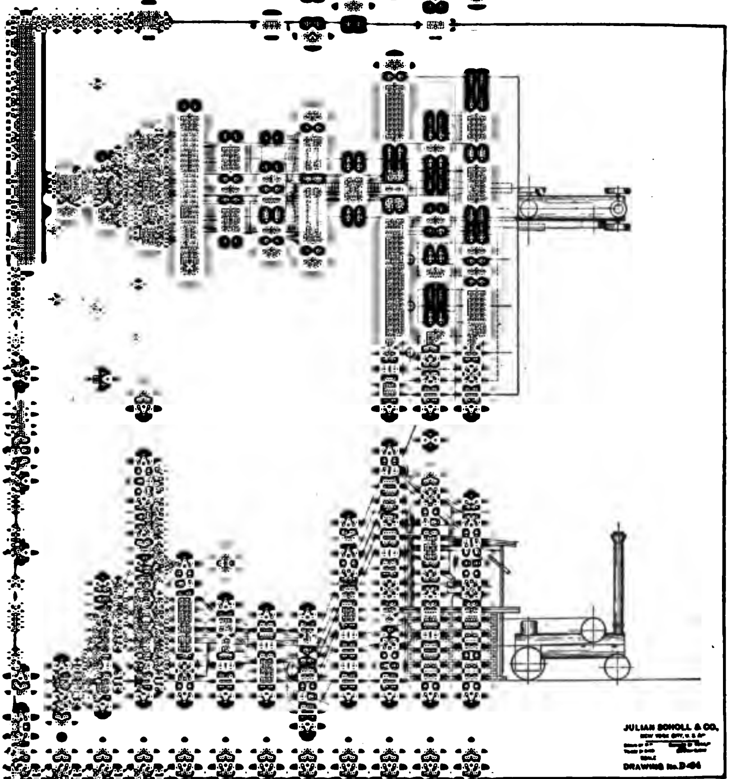


Inside diameter D	Outside diameter D_1	Thickness δ	Depth of bell l	Length of the transition of the pipe into the socket f	Thickness of lead joint K	Thickness of the socket at its end a	Auxiliary size for drawing the socket a_1	Depth of lead joint d	Interior swelling of lead joint m	Width of the rim of the socket C	Height of the recess where the pipe passes into the socket t	Height of spigot p	Width of spigot n	Length of pipe L	Weight				Inside diameter D
															Pipe without socket and spigot	Socket	Pipe with socket and spigot	Lineal metre of pipe with socket and spigot	
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	kg	kg	kg	mm
[40]	[55]	[7.5]	[62]	63]	[7]	[26]	[21.5]	[26]	[4.5]	[31]	[1]	[3.5]	[14]	[2000]	[16.23]	[3.22]	[19.50]	(9.75)	(40)
50	65	7.5	62	63	7	26	22	26	4.5	31	1	3.5	14	2000	19.65	3.64	23.35	11 68	50
[75]	[91]	[8]	[63]	[65]	[7]	[27]	[23]	[26.5]	[4.5]	[31.5]	[1]	[3.5]	[14]	[3000]	[45.37]	[4 93]	[50.39]	(16 77)	(75)
100	117	8.5	64	66	7	28	23.5	27	4.5	32	1	3.5	14	3000	63.02	6.44	69.57	23 19	100
125	143	9	65	67.5	7	29	24.5	27.5	4.5	32.5	1	3.5	14	3000	82.41	7.94	90.48	30.16	125
150	169	9.5	66	69	7.5	30	25.5	28	4.5	33	1	4	15	3000	103.54	9.62	113.35	37.78	150
[175]	[195]	[10]	[67]	[70.5]	[7.5]	[31]	[26]	[28.5]	[5]	[33.5]	[1]	[4]	[15]	[3000]	[126.41]	[11 64]	[138.27]	(46 09)	(175)
200	221	10.5	68	72	7.5	32	27	29	5	34	1	4	15	3000	151.03	13.67	164.95	54 98	200
[225]	[247]	[11]	[69]	[73.5]	[8]	[33]	[28]	[29.5]	[5]	[34.5]	[1]	[4]	[16]	[3000]	[177.39]	[15.99]	[193.68]	(64.50)	(225)
250	273	11.5	70	75	8	34	29	30	5	35	1	4	16	3000	205.49	17.93	223.75	74 58	250
300	325	12.5	72	78	8.5	36	30.5	31	5	36	1.5	4.5	17	3000	266.92	23.27	290.67	96.89	300
350	376	13	74	81	9	38	32.5	32	5.5	37	1.5	4.5	18	3750	402.99	29.39	432.95	115.45	350
400	428	14	76	84	9	40	34	33	5.5	38	1.5	5	18	3750	494.95	35.96	531.62	141.77	400
450	480	15	78	87	9.5	42	36	34	5.5	39	1.5	5	19	3750	595.65	43.89	640.40	170.78	450
500	532	16	80	90	10	44	37.5	35	5.5	40	1.5	5	20	3750	705.06	52.29	758.35	202.23	500
600	636	18	84	96	11	48	41	37	6	42	2	5.5	21	3750	949.97	73.06	1024 41	273 18	600
700	740	20	88	102	11.5	52	44.5	39	6.5	44	2	6	23	3750	1229.73	95.59	1327.22	353 93	700
[750]	[792]	[21]	[90]	[105]	[12]	[54]	[46]	[40]	[6 5]	[45]	[2]	[6]	[24]	[3750]	[1382.72]	[111.26]	[1496.14]	(398.96)	(750)
800	844	22	92	108	12.5	56	48	41	6.5	46	2.5	6.5	24	3750	1544.36	124.51	1671 30	445.69	800
900	948	24	96	114	13	60	51 5	43	7	48	2 5	7	26	3750	1894.10	156.57	2053.89	547.70	900
1000	1052	26	100	120	14	64	55	45	7	50	2.5	7	27	3750	2278 07	196.45	2478.25	660.87	1000
1200	1260	30	108	132	15.5	72	62	49	7.5	54	3	8	30	3750	3151.20	287.31	3444.11	918.43	1200

Remark: The placing of diam. of pipes in brackets signifies that they are used temporarily.

INDEX

[illegible] ASPHALT PLANTS



[illegible] manufacture Sand Driers, [illegible] Screens and Bins, Measuring [illegible] Asphalt Steam Rollers and [illegible]

[illegible] ROCK CRUSHERS, [illegible] O AND THREE-[illegible] ROLLERS

[illegible] & CO.,

[illegible] NEW YORK, N. Y.

[illegible]

...ca, N. Y., January 5, 1906

...nquiry will state that our ...ards of "Obispo" asphalt ...t six years. This is the ... wide. During this time ...n $300 for repairs and ...

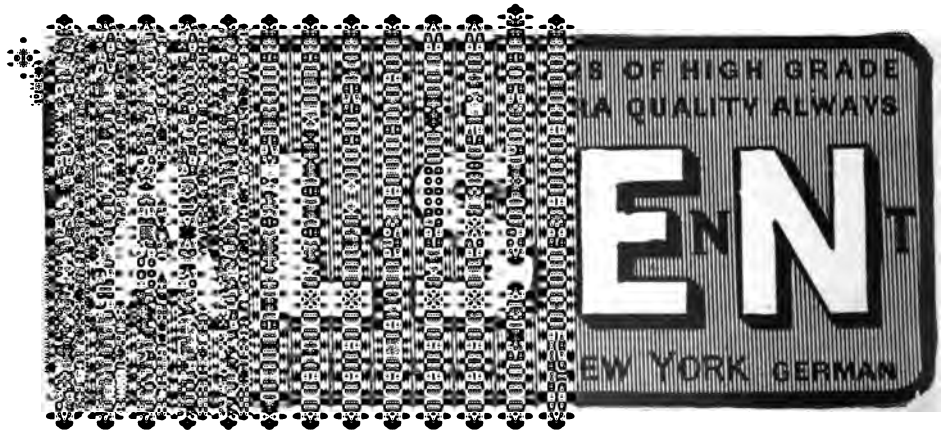
...VING CO.,
...as. I. Williams, President

...ALT CO.

...HALT

...ITTSBURG, PA.

WORKS
OBISPO, CAL.



Company

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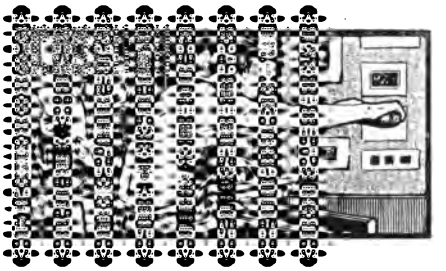

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